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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

public works - DEPARTMENT

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Building and Roads.
Civil Works.

No. 89.

READ—the following papers:—

Letter from Mr. Nordmann, dated 16th November 1881, No. 14 R.
Letter from Chief Commissioner, Central Provinces, Public Works Department, dated 16th November 1881, No. 9059.
Letter from Mr. Nordmann, dated 26th November 1881, No. 19 O.
" " " 4th December " " 20 B.
" " " 6th January 1882, " " 24 R.
" " " 14th " " " 27 R.
" " " 25th February " " 38 K.
" " " 30th March " " 60 W.
" " " 14th April " " 72 W.
" " " 18th " " " 74 W.

I.

INTRODUCTION.

Preparations for the Expedition.—In the Council held at Stonehouse, Ootacamund, on the 8th September 1881, which I had been asked to attend, it was settled that I should undertake the reconnaissance, and that Mr. Sub-Engineer Cornac should be attached to the party as my Assistant. Shortly afterwards I was supplied with maps and other information, while in G.O., No. 2294 W., dated 16th September, instructions were issued for my guidance.

2. *Tents and Stores.*—Tents were telegraphed for, by the Secretary to Government in the Public Works Department, all over India, but time pressing they could not be supplied sufficiently early for the expedition.

The Quartermaster-General's Department was indented on for tents, and it was believed that department would furnish the required number; but at the last moment it declined to supply any tents, as all available canvas—so it was stated—would be required for the troops to move into camp in case cholera, which was flying about, should break out seriously at one or more military stations. I was therefore directed to procure what tents I required from those available at the Central Jails of Coimbatore and Vellore. Accordingly I left Coonoor on the 9th October, and proceeded first to Coimbatore and then to Vellore, where I selected such tents as seemed most suitable for the purpose in view, namely combining lightness in weight with due protection from sun and rain, and reasonable comfort.

3. I had been decided that two complete sets of tents should be supplied for the expedition, so that one set should always be a day's march ahead, both in order to secure expedition in movement and a good sanitary condition of the party.

4. The number of tents selected—twenty—at first sight seems large; but it has to be borne in mind that two sets of tents were provided for every purpose, namely, one set for to-day's and one for to-morrow's camp; so that no one in camp should at any time be without shelter. This precaution was the more necessary, seeing that the expedition started in the face of the impending north-east monsoon and had to march through a country which has not the best reputation in the matter of malarious fever and its accompaniments.

5. The tents selected were—

(1) For the Executive Engineer and his Assistant.		L.B.	L.B.
2 Bengal Sleeping Pals 12' x 12', each weighing ...	...	222	=444
1 Hill tent 12' x 12' weighing ...	...	300	
1 Bath-room for do. ...	...	30	
1 Double-fly Bechoba 11' x 11' ...	...	230	
1 Bath-room for do. ...	...	30	=580
(2) For the Hospital Assistant and the Writer.			
1 Single-fly Bechoba 10' x 10' ...	...	135	
1 Rowty 9' x 12' ...	...	93	=228
(3) For the Revenue subordinate.			
2 Cabul Pals 6' x 7' ...	...	80	=160
(4) For the Police Guard, Stores and Baggage.			
2 French "tentes de troupe" 18' x 14' ...	...	90	=180
(5) For Lascars and other Camp followers.			
6 Cabul Pals 7' x 8' ...	...	80	=480
(6)—1 Small Sholdari for cooking in bad weather ...	...	55	=55
(7)—1 Necessary Tent ...	...	30	=30
(8)—2 Camp tents 7' x 6' for sundry purposes ...	...	60	=20
Total 20 tents, weighing=lbs. 2,277.			

NOTE.—Two of each kind of Nos. 6 and 7 were not available at short notice.

6. The tents having been selected, there was a further week's delay in Madras since all the tents could not be got ready for shipment by the British India Steamer the 13th October to Vizagapatam. This week was utilized by me in Madras in seeing the heads of the Government Departments concerned, and ensuring the timely despatch of all the stores, scientific instruments, &c., that had been ordered to be supplied. Some of these had been already sent on by the steamer of the 7th. On the day (20th October) when I embarked at Madras for Vizagapatam some of the tents from the Vellore Central Jail had not arrived at Madras.

For these I had to wait a week at Vizagapatam, where I arrived on the 23rd.

7. The week at Vizagapatam was made use of in unpacking, examining and repacking the tools, stores, instruments, &c., supplied; in pitching the new tents and making pegs for them (as most of the tents had come without pegs); in engaging a crew of tent lascars; observing aneroids, studying the maps, &c. I also conferred with the Master Attendant about the aneroid readings at sea level which are to be daily sent to me in camp for ascertaining altitudes in the country traversed.

8. There was a burst of the north-east monsoon and somewhat heavy rain at Vizagapatam on the 31st October and 1st November, after which the weather cleared up.

I left Vizagapatam for Vizianagarum on the 2nd November.

9. The tract of country between Vizagapatam and Párvatipuram was not reconnoitred, as it is well known to the Department of Public Works officers, and the levels are all on record.

This portion was therefore dawked over.

10. At Vizianagarum, which is 184 feet above sea level, I saw the Acting Agent, who gave me some useful information about such parts of the Jeypur country as are personally known to him; also His Highness the Maharajah, who seemed greatly interested in the success of the project and kindly lent me four of his elephants to carry tents and other camp equipage all the way to Raipur and back.

11. From Vizianagarum I telegraphed to the Secretary to the Commissioner of the Central Provinces, giving him my proposed route with the probable dates of arrival at places, and asked him to instruct the Rajah of Kálahundy and the Zemindars of Patna, Kariál and others to attach some responsible person to my camp to aid in procuring guides, camp supplies, coolies, &c.

12. I left Vizianagarum for Párvatipuram on the 7th November; the height of the latter place above sea level was ascertained to be 395 feet.

13. From Párvatipuram to Ryaguddah.—On the 12th November the reconnoitring party started on its march from Párvatipuram to Ryaguddah, one camp having been

sent ahead the previous day. On the 12th began the regular reconnoissance, the taking of measurements, observations, notes, &c. The weather had been fine hitherto; but now there were signs of impending rain.

14. The whole camp train consisted of 20 tents as before specified,

- 4 Elephants for carrying tents, &c.,
- 12 Attendants on do.,
- 40 Pack bullocks for carrying small tents, stores, medicines, instruments, camp equipage, baggage, &c.,
- 13 Men, attending bullocks,
- 10 Bullocks to carry food and kit of the bullock men,
- 3 Men attending on these bullocks,
- 1 Hospital Assistant,
- 1 Hospital servant,
- 1 Camp Writer,
- 18 Lascars,
- 6 Private servants,
- 3 Ponies,
- 3 Horse-keepers,
- 3 Grass-cutters;

Total 61 men, with 20 tents, 4 elephants, 50 pack-bullocks and 3 ponies; besides a daily varying number of coolies to carry instruments and sundries, and sometimes to relieve or assist elephants or bullocks in case of need; or carry the improvised dhoolies.

15. The Dewán to His Highness the Maharajah of Vizianagarum had informed me that the elephants—which were not large ones—should not carry more than 500 lb. each. However to this the mahouts generally objected on the journey, on the plea of the elephants being sick and sore, which they not unfrequently were. Two additional elephants were kindly lent to the party for a time, one by the Rajah of Bisemkattak, the other by the Manager of the Bindra Nougari Estate.

But even with this assistance a number of tents and nearly all stores and baggage had to be carried by bullocks.

The elephants, in addition to the tents, had to carry some of the mahouts and their kit, and generally a number of sick camp followers who were unable to march.

16. The pack bullocks were engaged for the whole journey from Párvatipuram to Raipur and back. This proved a very effective arrangement, as thereby a certain amount of carriage could always be depended upon; while if we had relied upon coolies only, we should in many places have been unable to obtain the number required, and thus the party would have been delayed in the jungles.

WALTAIR,
18th April 1882.

(Signed) K. F. NORDMANN,
Executive Engineer.

II.

From K. F. NORDMANN, Esq., Executive Engineer on Special Duty, to Colonel R. H. SANKEY, C.B., R.E., Secretary to Government, Public Works Department, Madras, dated Ryaguddah, 16th November 1881. No. 14-R.

In continuation of my letter No. 12-P, of the 12th instant, I have the honor to report that the reconnoitring party left Párvatipuram on the 12th and arrived at Ryaguddah, a distance of 30 miles and 6 furlongs, on the 14th instant, having satisfactorily attended to all necessary measurements, observations, the taking of notes, &c.

2. The weather, which had been fine up to the 12th, assumed a monsoonish appearance on the night of that date. It was cloudy on the 13th and 14th, with slight drizzling rain; yesterday, the 15th, the clouds gathered in a threatening manner; there was a heavy shower in the afternoon, and steady and continuous rain last night.

3. The track, which is passable for carts in the dry weather, from Párvatipuram to this, crosses the Narrainputnum river in the seventh mile, and then enters the valley of the Nágavully (or Chicacole) river, in which it runs up to Ryaguddah, keeping always within half a mile or so of the river bank. On both sides of the track are low ridges of hills. The valley is from one to three miles wide. The track is almost level, the longitudinal slope of the valley being very gradual.

4. The cross section is mostly flat; in some places the ground is undulating and cut up by ravines and large gullies caused by erosion, but generally it is level or nearly so. There is very little rock, and there are no difficulties in the way of a road or railway.

5. The soil, as a rule, is very fertile, though frequently of a light description. There is a good deal of jungle along the track, but less jungle than cultivation. The latter consists chiefly of dry crops, and there is also some paddy and sugarcane.

6. Villages are about a mile apart, and, on the whole, the country is sparsely populated; there is room for a greater population.

7. The hill ridges limiting the valley of the river are well wooded with trees and shrubs, and patches of cultivation are to be seen on the hill sides. The ippa tree grows here, besides tamarind, mango, jack, mathi, black wood, yégi, cashewnut, acacias, &c.

8. The dry-crops consist of six different oil seeds (as per margin); three fibrous plants (ganja or Indian hemp and two kinds of flax); cholam, maize or Indian corn, horse-grain, green-grain, ragi, cumbu, and three or four other kinds of food grains (gantalu, sámalu, idalu, and korralu).

Gingelly.
Two kinds of lamp oil.
Castor oil.
Oil from mustard seed.
Oil from the ippa tree seeds.

9. Of vegetables, the people cultivate yam, pumpkin, cucumber, water-melon, plantain, brinjal, bhirkai, bendakhai (Hybis-eus), &c.; tobacco is also largely grown.

10. Of minerals, there are kunkur limestone and iron ore. The ore is smelted at Jumnadahpettah, 10 miles south of Ryaguddah. Along the whole route there is kunkur limestone to be found, and suitable clay for brick-making. Building-stone will have to be quarried in the parallel hill ridges confining the valley of the river. The prevailing rock is gneiss, frequently studded with patches of quartz, and sometimes with red garnets.

11. The traffic I met is chiefly carried on bullocks. I saw paddy and hides coming from Ryaguddah, Bengal-grain from Kálahundy, rice from Sumbulpoor; all going to Párvatipuram.

12. The Ooriya people and language begin about 8 miles north of Párvatipuram.—There are some Khónd villages.

13. The drainage encountered between Párvatipuram and Ryaguddah is of an ordinary description: the large streams to be bridged are the Narrainputnum river in the seventh mile, 250 feet wide and 14 feet deep in flood; a stream in the sixteenth mile, 150 feet wide and 5 feet deep; and the river near Ryaguddah, 425 feet wide with a maximum depth of 22 feet.—The streams, as a rule, have sandy or gravelly beds; no rock for foundations, except in one or two cases, being visible near the crossings. There is a good, rocky bridge site for the Ryaguddah river.

14. I am preparing a continuous section of the country as I march along, which will be accompanied by a narrative descriptive of all prominent features and of the particular heads alluded to in paragraph 12 of G.O., No. 2294 W., dated 16th September last, as well as by sections of large streams.

15. The height of Párvatipuram above sea level is 395 feet; that of Ryaguddah I have not yet been able to calculate accurately, as the last aneroid readings from Vizagapatam have not yet reached this.* The

* Just received; altitude 687 feet. The aneroid here reads on an average 29.35, showing Ryaguddah to be about 700 feet above sea level.

16. I have not got the maps (scale one mile to the inch) of the country between Párvatipuram and Ryaguddah.

17. The health in camp has so far been good, except that the Hospital Assistant and the Writer have had a slight attack of fever.

18. The Revenue subordinate (paragraph 15 of the above-quoted Government Order) has not yet joined my camp; it having been found difficult to engage a suitable man willing to go, and able to speak English, Telugu, Ooriya, and Hindustani; I have this day written to the Agent to the Governor at Vizagapatam and requested him to endeavour to supply a man with all or most of the qualifications named.

19. I leave this to-morrow for Bisemuttak, Ombadola, Asurgor and Bógor; while Mr. Cormac marches *via* Singapore to Indesor, and thence to Dádpur and Bógor. We propose to meet first at Lonjigur, to complete the section of the line from Singapore to Ombadola; and then at Bógor, where I expect to be about the 1st proximo.

20. I shall thank you to inform me whether it is desired that I should march from Jalbal (seven miles south-east of Nára) northwards to Onki, about 20 miles, and back. If I do not hear from you about this a time, I shall make this march.

21. I request that two fresh perambulators may be sent for me to Raipur, to await my arrival there, as my perambulator shows signs of weakness and may be out of order and unserviceable by the time I arrive at Raipur.

22. I beg that letters may, till further notice, be addressed to "Ryaguddah, care of Sub-Magistrate, to be forwarded."

III.

From the Secretary to the Chief Commissioner, Public Works Department, Central Provinces, to the Secretary to the Government of Madras, Public Works Department, dated Nagpur, 16th November 1881, No. 9059.

I am desired by the Chief Commissioner to forward, for the consideration of the Madras Government, the accompanying copy of letter No. 6812, dated 10th instant, from Commissioner, Chattisgarh Division (with enclosures), with reference to the reconnoissance, ordered by the Government of India, of the country between Vizagapatam and Raipur for a line of railway.

IV.

From Colonel C. B. LUCIE SMITH, Commissioner, Chattisgarh Division, to the Secretary to the Chief Commissioner, Public Works Department, Central Provinces, dated 10th November 1881, No. 6812.

I have the honor to acknowledge the receipt of your letter, No. 7084, dated 1st September last, with its enclosures, and to say, after careful inquiry, that the project of taking the Vizagapatam-and-Raipur Railway west of the Mahánadi is doubtless feasible, but appears hardly advisable; because such a line must necessarily pass through a stretch of difficult country in the feudatory State of Kankér, which would entail a cost of construction that would probably more than counterbalance the gain obtained by avoiding the Mahánadi, while the line would lie altogether apart from the existing trade route.

2. The natural line I should judge to be that followed at present by the Brinjári traffic from Vizagapatam, which passes through Párvatipuram, Koontipenta, and Singapore, and crosses the Kálahundy border, 24 miles, as the crow flies, S.S.E. of Bhavánipatnam (called "Bondesor" on the maps). In this distance of 24 miles the only obstacle is the Músa ghát, which is, as the crow flies, about 12 miles S.S.E. of Bhavánipatnam. From Bhavánipatnam the road runs to the western border of Kálahundy, and then in a generally N.N.W. direction to a point about two miles east of Arang, where it strikes the Raipur and Sumbulpoor road.

3. With ordinary surface repairs the whole road from Bhavánipatnam to Raipur is easy for wheeled traffic during the open season, and it lies through fertile and for the most part well-cultivated country, as will be seen from the accompanying extract from notes recorded by me when marching along this route with carts in February and March last. I have estimated its present length at 179 miles, but probably by straightening the line in places the distance may be reduced to about 165 miles, and of this distance only some 35 miles are in feudatory territory.

4. Looking at the proposed railway from the Central Provinces point of view, there can, I think, be no question, but that the line most calculated to open out this division is the one I have sketched, and I should judge that the Vizagapatam authorities are in its favor. I have therefore written to Mr. Nordmann at Bhavánipatnam recommending it to his attention.

STATEMENT of Stages from Bhavanipatnam to Raipur.

No.	Stage.	Remarks.
1	Bondesor or Bhavanipatnam to Nandol.	Came out here <i>enroute</i> through Kariar to Raipur, distance about 12 miles; road fair for the wheeled traffic of the country; soil sandy running into brown and black; rice, tilli, peas, pulses, wheat and channa grown; country fairly cleared, and the following villages assed through:—Singjerram, Pukjori, Barjola, Tiljori, Kharr, Tekri and Atangura. Met many small country carts taking me to today's bazaar at Bhavanipatnam. Nandol has a fair encamping ground on the bank of the Sogora river, which has clearwater.
2	Nandol to Daspur ..	Distance about 1 miles; road good; in many places raised and generally aligned and planted with roadside trees; country generally wellcleared and cultivated with rice, pulses, some chenna and sugarcane high and picturesque hills clothed with forest and bamboos until the Tel river is reached, where the hills open out; soil sandy running into black and brown; passed through or near Kendupati, Oratola, Makartola, Bondagaon, Poondah, Faranggaon, Omta, at Daspur; good shade at Daspur, but the grove is close to sugarcane fields and a banded nullah; passed several nice groves on road.
3	Daspur to Golamunda.	Distance about 1 miles; came through Dumerbahal, Valuchua, Kholiakani to Golamunda; soil black the first half and sandy the second half; fair amount of cultivation, chiefly rice and castor; a few teak trees appear near Golamunda; a mango tope here with fair shade, but not a nice encamping ground. There is a Kálahundy Police post here.
4	Golamunda to Nandgaon.	Distance about 9 miles; past the Kariar frontier near Dhungiamunda for three-fourths of the way black soil and afterwards sandy; country fairly cleared, road rough on the Kariar side; came through Lumra, Dhungiamunda and Cholna to Nandgaon, which is a good encamping ground, having pleasant shade and clear water from the river near.
5	Nandgaon to Lorka.	Distance about 1 miles; road easy, although not always properly marked out; country well cleared and fairly cultivated; soil sandy and black; villages poor looking and very dirty; teak about; passed through Borgaon, Gondabahal, Gomargura, Kampur and Ankapur to Lorka; rice, chenna, tilli and castor chiefly grown; good shade at Lorka, but too close to village, and tank water fair.
6	Nandgaon to Polsodar.	Distance about 5 miles; soil chiefly black; small jungle and high grass with few clearings; passed through Khirmal and Lanji to Polsodar; fair shade and fair water, but a good deal shut in.
7	Polsodar to Kolin-ga.	Distance about 6 miles; soil sandy and black; not much cleared country; small jungle; road fair, but narrow; passed through Domjer. Kdinga has a large clearing and a good place for encamping with abundant shade; water from the river near.
8	Kolinga to Rojona.	Distance about 6 miles; road good; soil sandy; crossed the Under river twice; passed some clearings belonging to Chichali and Dhanggaon, otherwise the whole distance was through forest chiefly of fair extent of cleared land, with fair shade, and clear water from the Under river.
9	Rojona to Kisima ...	Distance about 9 miles; soil black and sandy; country fairly cleared, but not much cultivation; small open jungle; passed through or near Belgaoon, Agarom, Bila, Bandanpali to Kisima; villages all small, but many have good mango groves; good shade at Kisima, but encamping place too low.
10	Kisima to Torbor ...	Distance about 9 miles; road good; small jungle the whole way; soil at first black, afterwards sandy, open clearing at Torbor, and clear water but no shade.
11	Torbor to Tarnot ...	Distance about 12 miles; road good for the first half and then rocky and stony and over broken ground by the hills; soil of the first half chiefly black; only one village Lündi passed through; country has once been fairly cleared, but now has retrograded.

Statement of Stages from Bhavanipatnam to Raipur—cont.

No.	Stage.	Remarks.
12	Tarnot to Sarabong.	Distance about 7 miles; soil chiefly sandy; road good; country cleared, but not much cultivation. There are several tanks here and some sugarcane cultivation; villages passed through this morning were Jilmila, Rothipali and Malibata.
13	Sarabong to Tendubarra.	Distance about 6½ miles; road fair; no running water in the Jong river; passed through Pathalghutkuri; the whole distance from this village to Tendubarra under forest, but not unpleasantly dense; soil sandy chiefly; no teak and only sál here and there. Tendubarra has a fairly good clearing and fair water, no shade. Tendubarra is an high tableland, probably 1,400 or 1,500 feet above the sea. There is a good clear water from a kutchu well here.
14	Tendubarra to Bodrabanda.	Distance about 11 miles; road good; soil hard, red loam, no stones and only slightly rocky in one or two places; descents and ascents easy, nullahs not troublesome, in fact as good a country road as one would wish, and this is the road the Kariar Amlah induced Mr. Fisher not to travel over in 1873 and which they tried to induce me not to take. It should be widened and improved and will make a capital cart road at all seasons; passed Sirgidi, a small hamlet of Kariar, and a little way beyond entered the Khalsa of Raipur and passed through Charbati and Koknajer to this. There is some shade here and clear water from a kutchu well; all country over forest, but neither teak, sál nor bamboos to be seen.
15	Bodrabanda to Karti	Distance about 11 miles; soil sandy; country well cleared; road fair, but heavy in some places from sand; rice and some sugarcane grown. Karti has a good encamping ground and has a Police station-house.
16	Karti to Mahasamund.	Distance about 9 miles; soil at first black, afterwards sandy and then gravelly; country fairly cleared with mowah trees about; road fair and apparently much travelled by carts. Mahasamund is a large village on a gravelly rise, with fair shade at a pleasant distance from the village; rice, sugarcane, ulsi, and chenna grown.
17	Mahasamund to Paragaon (2 miles east of Arang).	Distance about 8½ miles; country cleared throughout; soil brown and yellow and laterite; crossed the Mahánadi by the Gorari ghát. The river here is much narrower than by the Arang crossing. Executive Engineer is making a branch road to this crossing from the Raipur and Sumbulpoor road.
18	Paragaon to Nuagaon.	At Paragaon the Raipur and Sumbulpoor road is struck, and the whole distance from Paragaon to Raipur is by that road. About 2 miles from Paragaon, Arang, which has a considerable trade with Kálahundy, is reached, and from Arang to Nuagaon the distance is about 12 miles; country cultivated throughout.
19	Nuagaon to Raipur.	Distance about 12 miles; country cultivated throughout.

NOTE.—The total distance from Bhavanipatnam to Raipur by this route is about 179 miles, but I should judge that by straightening the line in places the total distance may be reduced to about 165 miles.

(Signed) C. B. LUCIE SMITH,
Commissioner, Chattisgarh Division.

V.

From K. F. NORDMANN, Esq., Executive Engineer on Special Duty, to the Secretary to Government, Public Works Department, dated Ombadola, 26th November 1881, No. 19-O.

In continuation of my letter No. 14 R., dated Ryaguddah, 16th instant, giving an account of the reconnaissance from Párvatipuram to Ryaguddah, I have the honor here-

with to forward an extract from my diary from the 17th instant up to date; from which it will be seen that there has been no difficulty so far which could in the least obstruct a road or railway. A cart came with the camp to Bisemkattak, and might have come further.

2. The route travelled over has been, practically, almost a level; at least, the gradual ascent from the coast is a very easy one.

There has been nothing like a ghât or sudden and steep ascent in the way, so far; all has been plain sailing, and the people here say there is no ghât either, between this and Asurgor; this I will see to-morrow, and report on from Bôgor.

3. *Cooly labor and material* for work (such as building stone, clay for bricks, timber, &c.) are nearly everywhere available.

4. *The country* is, on the whole, well populated and cultivated, and might even be called rich; certainly, when its natural resources come to be developed, it may look forward to a very prosperous future.

5. *The people and their chiefs* are friendly disposed, and there has been no difficulty, so far, regarding guides, camp supplies, &c.

6. Along the entire route a great deal of *grain and other produce* is grown, much of which is now sent by pack bullocks to Parvatipuram, where it is bought up by merchants and distributed over the country; all this will go to swell the *traffic* of the railway. Besides this local traffic, there is a regular through-traffic from Raipur, Sumbulpoor and intermediate places, to Parvatipuram.

7. I met Mr. Cormac, according to previous arrangements, at Lonjigar on the 24th. He had come over ground as high as 1,603 feet, half way between Singapore and Lonjigar, while I have not yet encountered a greater altitude than 1,346 feet.

* Except at Lonjigar which is 1396 feet. Mr. Cormac marched back on the 25th to Chôthopoor (5 miles north of Singapore); thence he proceeds over the Mûsa ghât (near Kûndrû) to Bondesôr, Dâdpûr and Bôgor. I leave this for the last-named place to-morrow, via Asurgor.

8. *Readings of aneroids and thermometers* are taken at every mile, or so, along the route, or at every change of gradient, or remarkable feature of the ground, and at every stream. The "battery" of three aneroids, in a case, is registered regularly at 11 A.M. and 4 P.M. in each camp, so that the heights of all halting places can be readily ascertained and the others interpolated. It is not feasible to read the "battery" at 10-30 A.M., as we never reach the camp before eleven, having started with daylight. All the original records of every reading, whether made on the coast or on the march, will be carefully preserved, for future reference if necessary.

9. *The longitudinal section of the country* traversed cannot be conveniently prepared on the march, partly because all spare time, when the daily march is over, is occupied with packing, unpacking and general camp duties, and partly because the aneroid readings at the coast are not at hand when wanted, but come in a week or so after date, and will arrive still more irregularly later on. For the same reason, the altitudes now reported, and arrived at by simple methods without tables are, although very nearly accurate, strictly only approximate; the final altitudes will be given in the section which I shall prepare at Raipur, where I intend to make a halt of ten or twelve days to bring up arrears of reports, accounts, &c., and refit the expedition for the journey southwards.

10. This part of the reconnaissance I propose to carry out in two divisions; one party proceeding from Raipur, via Dhamtari and Kankêr, to Raigarh; while the other marches via Rajim to Noagarh and up the valley of the Sendor river, to Raigarh.

11. *The monsoon* has, on the whole, been merciful to the party; only one tent has been blown down; the people say the rains are over, the cold weather has commenced, and that there will be no more rain, although last night heavy clouds came up again from the north-east, but they have passed on.

12. *The health in camp* is satisfactory; the Hospital Assistant has recovered from his attack of fever; there are only a few slight cases of cold and fever.

13. I send, by parcel post, three specimens of quartz (which I have had pulverized for convenience in transit), two from Gowdugooda and one from Kordâband.

Both places are between this and Bisemkattak. I should be glad if the specimens could be chemically analyzed and assayed, to see if they contain any valuable metal.

14. So far the special *tappal*, despatched by the Sub-Magistrate from Ryaguddah, has arrived in camp pretty regularly twice a week. How it will be beyond Bôgor, remains to be seen.

I request that all orders, &c., despatched after receipt of this, may be addressed to "Arang, Central Provinces, to await arrival," where I hope to be about the 20th proximo.

P.S.—I must apologize for the indifferent calligraphy and the numerous corrections, &c., in this letter and the accompanying extract from notes; the only writer I have been able to engage for the tour is but an indifferent office hand.

VI.

EXTRACT from Notes of Reconnoissance between Bisemkattak, Ombadôla and Lonjigar, 17th to 25th November 1881.

From Ryaguddah to Bisemkattak.—Distance 29 miles 4 furlongs 191 yards.

It had been arranged that, while I marched via Bisemkattak and Ombadôla to Bôgor on the Têl Nadi (which is a tributary of the Mahânadi), Mr. Cormac was to proceed via Singapore, Bondesôr and Dâdpûr, likewise to Bôgor, where our camps were to be rejoined. Meanwhile we were to meet, en route, at Lonjigar; I coming from Ombadôla, and Mr. Cormac from Singapore, so as to complete the section of the line from Singapore to Ombadôla. Accordingly I left Ryaguddah on the 17th November for Bisemkattak, while Mr. Cormac started on the 18th for Singapore. His own report on his march, with sections, &c., will follow.

17th November, *Ryaguddah to Gingerabâdi.*—Distance 8 miles, 2 furlongs. Rise 49 feet.—Marched through a fine, level, upland country; light soil, well cultivated with extensive dry crops and some paddy. No jungle in this part of the valley, which is formed by two parallel ranges of hills, about 3 miles apart. Saw scarcely an acre of uncultivated land for several miles. The country is easy to travel over; there is a bandy track to which the Local Fund Board are doing some repairs.* Met

* But the grant is too small to do much good. some rice coming from Patna and Kâlahundy, going to Parvatipuram. There are good topes for camping along the whole route; good water is almost everywhere to be found in the small hill streams.

In the third mile there is some broken and irregular ground at the large village of Comellyphettah, 5½ miles from Ryaguddah; the *Nâgavully* river has to be crossed below its junction with a smaller affluent. The river in flood is 363 feet wide with a maximum depth of 15 feet. The bed is sandy, the low banks are flooded in the heavy rains, there is no rock for foundations visible.

To the north of this river the level upland valley continues as before; there is some jungle, but still much dry cultivation, with numerous fine mango, tamarind, fig, ippha and other trees growing in the fields. *Tree planting* is largely attended to by the people, and the trees are fenced in and cared for.

Topes occur frequently. The names of villages I passed are Kulligoodah, Kotapettu, Prodiguda, Comellyphettah, Jugganâdupetta.

Near *Gingerabâdi* a number of rocky hillocks are dotted over the valley. The rock is gneiss. There is a swampy pond, fed by hill drainage and covered with lotus flowers, near the village; the road passes below the pond. The water here is not very good. The fine upland valley now becomes narrower, the ground more uneven, the extent of jungle greater.—

The soil here is rich, of a dark brown color, almost black. There is a good deal of *paddy* cultivation.—It rained in the afternoon and at night.—Thermometer 80 to 85° F.; height of *Gingerabâdi* above sea level 736 feet.

18th November, *Gingerabâdi to Ballingy.*—Distance 10 miles 4 furlongs 123 yards.

Rise 400 feet. Thermometer 74 to 86° F.; height of Ballingy above sea level 1,136 feet.—Started as usual at 6 A.M.

The sky was covered with clouds, the atmosphere moist, the low hills were wrapped in mist.

Jungle and cultivation, both wet and dry, alternate along the track.

The soil varies, being sometimes sandy, then clayey, loamy, some black. The track is smooth and level, and the country studded with small hillocks, 100 to 200 feet high, some rocky, some with patches of cultivation, the latter chiefly castor-oil and cholam.

In the 3rd mile the track leads for some distance along a gently sloping hill side. There is more jungle and less cultivation. Some rock is met with; gneiss mixed with quartz and conglomerate, and containing occasionally red garnets (yerra kalli).

Trees abound in the cultivated fields, such as ippe, fig, tamarind, blackwood, maiti, mango, and jack; line old banyan trees, with far spreading leafy roofs supported on root pillars dropped from the branches; and others. The soil is mostly light, but seems to grow anything.

In the 4th mile there is some uneven and broken ground on both banks of a stream* which when in flood is 350 feet wide, with a maximum in depth of 15 feet.

* 2 miles 2 furlongs 110 yards.

The bed is sandy, there is no rock visible near the crossing; one bank is high, the other low (alternately) and flooded.

The river lies in a deep bed. The traffic I met consisted largely of Bengal gram (chenna) from Kalahundy, going to Parvatipur. On the northern bank the ground rises rapidly from the river bed, and is covered with light jungle.

In the 5th mile near the village of *Gajelpadu*, there is some undulating ground, but offering no obstacle. Small-kunker limestone is here scattered over the surface, and there is a tank near the village. At the 6th mile is the village of *Santa Beddigam*, at the foot of a low ridge covered with jungle. The valley here is only a mile and a half wide; the western ridge covered track continues smooth and level over light soil, as before. Wet and dry cultivation, paddy, sugarcane, ragi, gram, linseed (sersa), gingelly, rape, mustard, cholam, cumbu, castor-oil, and tobacco, &c., date and sago palms.

In the 7th mile is a stream, 130 feet wide and 10 feet deep in flood, with ill defined banks, bed sandy with gravel, no rock visible.

Country hilly, track undulating, partly along hill side, more jungle than cultivation. The sandy path descends slightly to *Bathpura*, 8th mile.

In the 9th mile another stream, 112 feet wide and 8 feet deep in flood. Banks alternately high and low, one bank flooded. Bed, hard soil with small stones and gravel; no rock near. For some distance through hilly jungle over broken ground; no cultivation; kunker limestone on the surface. Then flat country again, with patches of dry crops and numerous trees; some good timber, viz., teak, maiti, and blackwood.

The sides of the hill ridges forming this valley are now wooded, and partly cleared for cultivation. Clouds threatening ahead; rain at night. One of the Vizianagram elephants was sick and sore, and refused to work; some of the tents had to be carried by pack bullocks and coolies.

There is a thatched bungalow at *Balingy*, belonging to the Bismkattak Rajah, who had sent a Kotwal to meet me here to act as guide and procure supplies, coolies, &c. The village is a very small one, but the surrounding country is well populated, little hamlets lie hidden in nooks and corners.

19th November, *Balingy to Bismkattak*.—Distance 10 miles 2 furlongs. Rise 18 feet. Thermometer 74 to 84° F.; height of Bismkattak above sea level 1,114 feet. Distance of Bismkattak from Vizagapatam, 146 miles 4 furlongs.

Low clouds and mist. The ground along the track rises steadily; there is much jungle and little cultivation; the valley becomes narrower. The path runs along the foot of the eastern ridge, where very slight hill side cutting would be required for a road or railway. This ridge is covered with dense jungle and forest; the soil is good and the vegetation luxuriant, which shows there must be ample moisture; coffee ought to thrive here. The ridge on the left is more rocky, the alluvium on its eastern aspect partly worn away by the north-east monsoons of ages. The hill sides are cleared in patches, whereon grow the castor-oil plant and cholam.

A mango tree in the 3rd mile; country again flat, the two parallel ridges only about a mile apart; they rise here up to 500 feet. Very few patches of cultivation along the route.

At 3 miles and 3 furlongs a stream, width and depth in flood, respectively, 85 feet and 8 feet. Banks well defined, bed stony, but no solid rock apparent.

The track now runs across the slope of the western ridge; very slight hill side cutting wanted for the road. At the 4th mile a small but deep nullah; bridge, of 10 feet span, 15 feet high, required.

The ground is uneven, cut up by gullies. Some of the peaks of the *Nidngiri hills* come in sight. Soil brown clay mixed with sand; jungle. Another stream, smaller than the last, near the village of *Baiapodur*. The track here changes again to the slope of the eastern ridge, on which there is some rock cropping out along the track. The ground is irregular, but not difficult for a road. At 4 miles and 6 furlongs there is a bifurcation of tracks, one line leading to Bismkattak, the other to *Bariguda* and *Tikirapara*.

Near *Satikona* is the summit level of the track, so far, 1,346 feet above sea level; from here the ground descends to Bismkattak.

I met some carts with rice, from *Tikirapara*, Bariguda. The cart-men complained that the Sakal (Dhoby) of Bariguda charged a day. The *Prinjaries* seem to prefer the route by Singapore to and from Raipur, on account of the open and level ground to be found along that route.

Altogether I have not met very much traffic along this line up to this, perhaps 150 bullocks a day. The *Prinjaries* seem to prefer the route by Singapore to and from Raipur, on account of the open and level ground to be found along that route.

There is much cultivation round the village of *Satikona*. From here begins a steady descent along the slope of the eastern hill range. At 6½ miles the track passes through a saddle, thence the descent continues towards *Matakeri* and *Batuguda*.

There is light jungle and but little cultivation. Soil ordinary, reddish clay with sand. The path bends to the eastward to get round the Bismkattak hill.

Bismkattak is a little way out of the straight line to *Tikirapara*, but being a place of some importance it would seem correct to take the rail to Bismkattak and have a station there.

The path continues through jungle, with occasional clearings and sparse cultivation, over level ground along the foot of the hill, to *Bismkattak*, which is situated in the midst of hills and jungle, with a considerable extent of dry crops and paddy fields. To the west rise nearly up to 5,000 feet the peaks of the beautiful *Nidngiri hills* (the nearest only 5 miles from here); a range some 20 miles long by 5 miles in width, covered with jungle and forest.

If the rail is taken here, these hills may in time become a local sanitarium as well as a resort of planters. Coffee, tea and cinchona should thrive on the slopes.

There was heavy rain on the night of the 19th; one of my tents was blown down and damaged. It rained on the 20th during the day, and again very hard at night. The monsoon seemed full upon us. I despatched a camp to *Kordaband* en route to *Ombadola*.

20th November, halted at *Bismkattak*.—The *Tat Rajah* (who pays tribute to the *Rajah of Jeypur*) was so civil as to call upon me. He speaks Oriya and some Hindustani. He expressed himself highly pleased with the prospect of a railway, and offered all assistance in his power to the reconnoitring party. He has been reigning for the last seven years. His people promptly furnished guides, coolies, camp supplies, &c., and he was also good enough to lend me one of his elephants to accompany the party as far as the *Tel Nadi*, to relieve the *Vizianagram* elephants, one of which has a sore on the shoulder, seems much fatigued, and is unable to carry its proper load.

I returned the *Rajah's* visit within an hour, and he asked me to inform the Government that he had done all he could in furthering the expedition, which I have much pleasure in herewith bringing to notice.

The *Rajah* sent a Kotwal with me to assist my camp on the road. The Police Inspector, an Oriya man, also offered to accompany me, which offer I accepted; his beat extends as far as *Ombadola*, and he made himself very useful in camp and on the march.

The Hospital Assistant still suffered from fever at *Bismkattak*, but has since been free from it. He brought a cart to this place all the way from *Parvatipuram*, but sent it back from *Bismkattak*, as it has become difficult (though not impossible) to take the cart further. Being sick, he has now moved onwards in an improvised dhooly.

The general health in camp is satisfactory.

From *Bismkattak* to *Ombadola*. Distance 23 miles 7 furlongs.

Distance of *Ombadola* from *Vizagapatam*, 170 miles 3 furlongs.

21st November, *Bismkattak to Kordaband*, 12 miles. Rise 38 feet. Thermometer 69 to 77° F.; height of *Kordaband* above M. S. L. 1,192 feet.

A fine morning, the clouds rising, the sky gradually cleared up, a cool northerly breeze set in, and it seemed as if the monsoon had passed on southwards for good. There was also a change in the temperature; it suddenly became cooler.

In the first mile a stream was crossed, 100 feet wide when in flood and 6 feet deep; bed, sandy shingle; no rock; gently sloping banks.

After passing through half a mile of paddy fields, the track lies through dense jungle, between two low ranges of hills. The soil is light clay, mixed with sand, and sometimes stony, very little rock.

The villages passed were *Puttamunda*, *Gontakal*, *Gordigaon*; a small stream (at 3½ miles) near the latter, requiring a bridge of 10 feet span, 5 feet high. Some dry cultivation near the villages; otherwise dense jungle.

Two furlongs further a larger stream near *Goilkona*, 25 feet wide by 5 feet deep; rock for foundation. Some paddy-fields here. Near the 4th mile the village of *Bondiguda* with extensive paddy-fields. Further on *Burchiguda*; dry cultivation in the midst of jungle.

Junction with track from *Satikona* to *Tikirapara*. At 5½ miles the village of *Depaguda*, with hundreds of acres of rice cultivation, all by means of little channels taken off from the hill streams. Then some open ground, not cultivated. Stream 25 feet wide and 6 feet deep; high banks; no rock; bed, sand with shingle. Some paddy and sugarcane.

Village of *Dendra*.—Track goes on through jungle; low hill range on the left, with a few patches of clearing. Very little traffic along this route, which may be owing to the monsoon. Some carts were loading rice in the fields; the crop is just being cut.

At 7½ miles, *Tikirapara*.—A large double village, viz., for *Paiks* and *Khonds*, 100 houses. Tank, wet and dry cultivation. A hundred bullocks, with Bengal gram, from *Kalahundy* to *Parvatipuram*.

Numerous trees have died in this part of the country, which may be owing to the effect of the droughts of late years; some men said the trees had been ringed preparatory to being felled for timber and so killed, but I saw the rings only in very few instances.

At 9½ miles a stream requiring three spans of 30 feet each, height 10 feet; bed, shingle, no rock. Banks low and flooded; jungle; village of *Jamaraguda*; some dry cultivation.

Chellannalla village, 10th mile. Fine tope for camping.

11th mile.—Small nullah, waterway required 10 feet wide, 5 feet high; jungle here and there cleared.

12th mile.—Kordaband, dry and wet cultivation; fine tope, good water. The Sub-Magistrate of Gumpur had sent a peon here to attend my camp.

Height of Kordaband above M.S.L. 1,192 feet.

Good camping ground. Tank; thatched bungalow; rich dark soil. A quartz reef; sample powdered and sent with the report. No mercury in camp for experiments.—Cold at night. Thermometer 55 to 60° F.

22nd November, Kordaband to Ombadola.—The monsoon seems to have passed southwards, for good. The night at Kordaband was cold, the sky clear, the morning crisp; not a cloud. Passed through extensive rice-fields to a small stream in the first mile; good banks, firm bed, no rock; bridge required, 10 feet span, 5 feet high. Two furlongs further another similar stream.

1 mile 3 furlongs.—Village of Kutubedi; thermometer at 7 A.M. 57° F.; jungle and dry cultivation; hills on both sides; good tree jungle; soil moderately rich.

One furlong further, small stream like the two last; quartz in the ridge on the left.

Village of Doikal.—Sugarcane, rice and dry cultivation.

3 miles 2 furlongs. Panimunda stream.—Three 30 feet spans required, greatest depth in flood 9 feet; rock for foundation. There is a crude anicut made here by the villagers who have utilized for this purpose a rocky ledge extending across the bed of the stream; from the anicut a considerable irrigation channel is led off.

* Specimen sent with report.

3 miles 7 furlongs. A quartz reef near the village of Gauduguda.*

Two furlongs further a stream, with stony bed and high banks; bridge required, 23 feet wide, 6 feet high; undulating country, hills on both sides, tree jungle, patches of dry cultivation.

5 miles 3 furlongs.—Another quartz reef near Sicapodro. The track then passes over a small ghât about 50 feet high (the railway would round the hill or be cut through it) to the village of Dombisi.

A small stream, 14 feet wide, 4 feet deep in flood. The jungle here is a forest of large trees, containing some good timber, especially matti (Telegu, madhi chettu).

A small nullah, coming from swamps and paddy-fields on the rising ground to the left, 8 feet wide, 3 feet deep in flood.

6 miles 6 furlongs 187 yards.—Two villages close together of the name of Mudirikuppa, one for Khonds, the other for Paiks or Gaudus; hilly undulating ground; jungle, with some cultivation.

7 miles 2 furlongs.—Stream, 60 feet wide, 8 feet deep in flood; good banks, no rock.

The track, after leaving Bad Mudirikuppa, passes through a gorge with dense jungle; some hill side cutting required, then flat ground again. In the gorge I picked up some rich magnetic iron ore, and some ore of antimony.

8 miles 5 furlongs.—Village of Chunnikonti (Khond). The railway here should follow the course of the Bongdara river.

9 miles 3 furlongs.—Village of Peddagoodah on the left, Ranigooda in front.

10 miles 67 yards.—Cross the Bongdara river above its junction with Ombadola river; rock for foundation, gneiss studded with quartz; kunker limestone on the spot; width of stream 210 feet, greatest depth in flood 15 feet; banks flooded.

11 miles 7 furlongs. Ombadola.—Extensive rice-fields, fine country, well populated, studded with topes and trees and surrounded by hills, so that it is difficult to obtain a view; height of Ombadola above M. S. L. 1,196 feet.

23rd November, halted at Ombadola.—Heavy dew at night, mist in the morning. Thermometer at 6 A.M. 53° F.; in the day up to 80°.

The old Amin of Ombadola, who is under the Rajah of Bisemkattak, came to see me and expressed himself pleased with the prospect of a railway. I despatched a camp to Lonjigar with one elephant, five bullocks and ten coolies. The Police Inspector from Bisemkattak with some of his men, two of my Police men, and the Ombadola Amin's son accompanied the party.

I had to sleep in the Dresser's Rowly, as my tent that was blown down and damaged at Bisemkattak was being mended. There is a blacksmith at Ombadola who, in the most primitive manner, forged thin iron bands out of a thick bar of country pig iron; but there was no carpenter in the place to help in mending the broken poles.

24th November, Ombadola to Lonjigar.—Distance 12 miles. Heavy dew at night and in the early morning; clear sky in the day; thermometer 6 A.M. 55° F. Through paddy-fields and jungle; track frequently invisible.

1 mile 1 furlong.—Stream 126 feet wide, 9 feet deep in flood. Bed sandy and gravelly, no rock, banks low and flooded. Enter jungle, some sheet rock, gneiss with quartz veins. Village of Kutrikupa, a few huts, with some dry and garden cultivation.

I have noticed so far a singular absence of game in these parts. I have not seen, but Párvatipáram and this, a single snipe, partridge, jungle fowl, hare, pig or deer; but jackal, numerous, and bear, pig, sambur, cheetahs and tigers are said to be in the denser jungle on the

2 miles 158 yards.—Village of Kutrapali; high and dry ground, little cultivation, cotton, oil-seeds, beans, and ragi; then jungle again. Passed the boundary between the and Kálahundy estates.

Village of Dhorabetta.—A few small patches of paddy in the jungle, irrigated by little rills led from springs or small hill streams. Joined the track leading from Lonjigar to Raipur via Kutegu, Topi, Kindera, Prokriband, and Sigriguppa; another small nullah.

4 miles 1 furlong.—Village of Bijethadu; some dry crops and paddy in the midst of jungle.

4 miles 7 furlongs.—Village of Toral; a little beyond, abundance of gneiss rock which can be quarried for building stone.

7 miles 1 furlong.—Good camping ground in a tope; again jungle.

7 miles 2 furlongs.—Stream near the village of Nangelbeda, 34 feet wide, 9 feet deep in flood; good banks, gravelly bed, no rock near crossing. Half a mile further a small nullah with rocky bed. Kunker limestone is found on the surface in many places along this day's route.

—Jungle again; then a shallow stream, 26 feet by 4 feet; sandy bed, low banks, no rock; then an irrigation channel led off the stream through some deep cutting.

Village of Batuguda.—The hard clay in the bed of the channel has been worn by the water into the outward appearance of laterite, but there is no laterite here.

Village of Chatterpore.—Clear water in the small hill streams.—This part of the country is but sparsely inhabited, and there is ample room in these jungles for immigrants. The soil is good enough for paddy, sugarcane, and all ordinary dry crops; water from streams and springs is plentiful; trees, shrubs and grass grow luxuriantly; the paddy and ragi crops look very fine, although the rainfall has not been ample this year.

9 miles 6 furlongs.—Another village of Batuguda; some dry cultivation, then again jungle. Here begins a dense jungle and forest of young trees, the latter 15 to 20 years old; soil varying, sometimes light and sandy, sometimes heavy clay. Small nullah, 6 feet wide by 2 feet deep.

11 miles 1 furlong.—Nullah 15 feet wide and 4 feet deep in flood, high banks, stony bed, no rock visible which, however, is not far below the surface here. The sand in this stream contains shining yellow mica dust.

12 miles.—Lonjigar, at the foot of a hill upwards of 3,000 feet high, part of the Niángiri range; large village, surrounded by hills; 100 houses (mud huts, thatched), ample fields, gardens and trees; a tank under construction; soil dark, rich clay, some nearly black. There are weavers, blacksmiths and goldsmiths in the village; no carpenter, just as at Ombadola. The old headman of the village was very civil, brought offerings of rice, fruit, &c., and said he was glad that there was a chance of a good road or railway being made in these parts. He also said that there had been no white man at Lonjigar since the Surveyors were here, some eighteen years ago.

The Rajah, who is tributary to Bondesor, has gone to Raipur; his two sons called upon me, one 25 and the other 18 years of age. The younger one can read and write Oriya, the elder has no education. They speak Oriya and a little Hindustani; the elder is a Shikari and told me he had shot five tigers. There are man-eaters here, and people are occasionally carried off.—Here I met Mr. Cormac who had come up from Singapore according to arrangements made at Ryaguddah.

The report on his march from Ryaguddah will, I hope, be sent from Bógor.

The greatest height he has come over between Singapore and this is 1,603 feet; thermometer 52° F. at night.

The people at Lonjigar, as well as at Ombadola and along the track between the two places, were quite civil, giving correct information and showing the way readily when asked. Nor were they shy; neither men, women, nor children ran away at our approach, as they sometimes do on the Jeypur Hills. The men have a martial look about them.—Height of Lonjigar above M.S.L. 1,396 feet.

25th November; returned to Ombadola, while Mr. Cormac marched back to Chóthopoor (on the way to Singapore); whence he is to go on to Bondesor, Dádpur and Bógor.

The people say the monsoon is over, there will be no more rain, and that the cold weather has set in. However, on the evening of the 25th, heavy clouds were coming up again from the north-east, and it was a warm evening in consequence; but the clouds have gone off southwards.

(Signed) K. F. NORDMANN,
Executive Engineer on Special Duty.

OMBADOLA,
26th November 1881.

VII.

From K. F. NORDMANN, Esq., Executive Engineer on Special Duty, to the Secretary to Government, Public Works Department, dated Bógor, 4th December 1881, No. 20 B.

I HAVE the honor herewith to forward the report and "notes" on the progress of the reconnaissance from Ombadola to Bógor, and from Ryaguddah via Singapore, Bondesor and Dádpur; in continuation of my letter No. 19-O, dated 26th ultimo.

(from Ombadola) and its enclosures. The country traversed is described in detail in the notes.

2. The route from Ombadola northwards has continued to prove an easy one.

* 87 feet above Ombadola and 1,233 feet above M.S.L. The only approach to anything like a ghât is a decline which begins on the summit level,* 3 miles and 5 furlongs north of Ombadola. Thence the present track descends by varying, but chiefly easy gradients to the 7th mile, with a total fall of 220 feet in 3 miles and 3 furlongs, or about 1 in 80. The descent, along the track, at first is rather steep immediately below the summit; but there is no need for such a rapid descent, as there is room to take the line on higher ground along the hill side and so reduce the gradient which need not exceed 1 in 100, if the northern foot of the descent is thrown out as far as the 8th mile from Ombadola, which is quite practicable. *This is all there is like a ghât, on this line.*

3. Mr. Cormac coming from Bondesor joined me here (Bôgor) on the 1st instant. I submit, in original, his report on his march, and an approximate longitudinal section of the country travelled over by him. The altitudes given in his section, though nearly correct, are strictly only approximate, as he had only two detached aneroids which read differently from mine (and a thermometer), and had not the "battery" to refer to which came with my camp. Moreover the aneroid readings on the sea coast are wanting to complete the exact calculations. A revised section will have to be prepared when those readings are all received. For this reason I defer, as I have already reported in my last letter, sending the section of my route till I have all the sea coast readings. I hope to send the correct sections from Raipur; meanwhile the approximate altitudes, which are very nearly accurate, are indicated in the notes.

4. It will be seen from Mr. Cormac's report and section that the Singapore-Bondesor route, which passes over the Mûsa ghât a mile north of Kûndrû, ascends to an altitude of 2,048 feet, and has a considerable ghât to descend on the northern slope; while the highest point reached on the Ombadola route does not exceed 1,346 feet, near Satikôma, with (practically) no ghât, or only a faint approach to one. Hence, other considerations on both lines being equal, the Bisemkattak-Ombadola line must be considered preferable, for a railway, to that via Singapore and Bondesor. Nor is it advisable to take the line from Ryaguddah, via Singapore and Lonjigar, to Ombadola, since there is a ghât to cross, 1,603 feet high, between Singapore and Lonjigar (at Tirmui).

5. At Dâdpûr Mr. Cormac crossed the trade and old military routes which lead from Chicacole to Kamptee, one via Bateli, Mukuli, Dâdpûr, Junâgar, Kankér, Wairâgar and Umber (No. 44 in the Quartermaster-General's route book); and the other via Junâgar, Karial, Arang, &c. (No. 45 in the same book).

1. From Bondesor via Dâdpûr to Bôgor.
2. From Bondesor via Turkel and past Ojarnar to Badheng.
3. From the Mûsa ghât via Junâgar, Daspûr and Manjher to Karial; or
4. From Manjher via Borgâon and Polsodar to Kûmûna; or
5. From Manjher via Borgâon, Binapur and Balda to Torbor.

6. The short cuts marginally indicated, which might be obtained by using the Mûsa ghât, would scarcely compensate for the inconvenience and extra cost that would be caused by that ghât; the less so since those short cuts would have to cross several formidable rivers, besides passing through some otherwise difficult country.

7. Bôgor is 628 feet above M.S.L., 20½ miles from Vizagapatam, and about 160 miles from Raipur by the route via Kumûna, Nara and Arang. There is a good bridge site for the Têl Nadi near Bôgor, with rock visible in the bed on the northern bank, and extending most probably across the river, not very deep below the sandy bed. This bed is rather treacherous, in trying to cross this morning my horse sank with me up to the girths into the quicksand. The water is sufficiently low to permit fording. In heavy monsoons the banks are flooded on both sides; hence considerable embankments will be required in order to have the bridge, as it ought to be, at least 30 feet above the deep bed.

8. The last letters and papers I have received are dated the 13th November. I despatch this post to Bisemkattak by the Tât Rajah's elephant which returns from here according to agreement, thence the packet is to be forwarded by the beat

constable to Ryaguddah. I scarcely expect to receive any further tappal until I reach Arang. I write to Ryaguddah and Vizagapatam to redirect to Raipur. I request that all letters may, till further notice, be addressed to "Raipur, C.P., to await arrival."

9. Fever begins to prevail in the camp.

10. We leave this to-morrow for Karial, Kûmûna, &c.

VIII.

EXTRACT from Notes of Reconnaissance, Ombadola to Bôgor, 26th November to 3rd December 1881.

26th November, Ombadola.—Went out and examined the lay of the country with reference to the proposed railway.

Traffic.—Thirty pack bullocks from Maringi and Kurpâni, without loads, going to the Nandapûr taluk of Jeypur, via Kâlahundy, to bring down grain, &c.

A hundred and ninety pack bullocks coming from Kâlahundy, going to Pârvatipûram, with rice, gingelly and mustard seeds, Bengal gram and paddy.

Cooly labor.—This is at present very cheap, there being so little demand for it; except for agricultural operations when the laborers are paid in kind, coolies can be had at 1½ annas per day. If there were a heavy and steady demand for labor, as on a line of road or railway, the daily rate would doubtless be higher.

Artisans.—These are very scarce at Ombadola. I could get a jungle blacksmith to repair my broken tent poles, but there was no carpenter in the place. Weavers there are, but no tailors or chucklers; anything required in this line by the well-to-do people of Ombadola has to be procured from Pârvatipûram.

27th November, Ombadola.—Sunday. Dew at night and in the morning. Thermometer at 6 A.M. 55° F. Fine day. Despatched one camp 10 miles ahead to Sorigura en route to Bôgor.

From Ombadola to Bôgor; 28th November, Ombadola to Sorigura.—11 miles 5 furlongs 176 yards. Descent from Ombadola to Sorigura 269 feet; distance of Sorigura from Vizagapatam 182 miles. Height of Sorigura above M.S.L. 927. Thermometer 6 A.M. 60°.

Through paddy-fields and jungle; at 5th furlong a stream, 35 feet wide, 7 feet deep in flood, good banks, gravel bed. Planted topes alternating with jungle and dry crops. Village of Kamrabal; small stream 10 feet x 4 feet; jungle.

Bijapûram.—Jungle and dry cultivation. The road, if so it may be called, is here a broad and well-beaten bullock track leading through jungle.

At 3 miles 5 furlongs 153 yards from Ombadola the summit level is reached by a steady and gentle ascent without a ghât or anything approaching a ghât. This summit level is 1,283 feet above M.S.L. and 87 feet above Ombadola; a rise of 1 in 225 from the latter place.

From this summit begins the descent northwards. A small stream requiring a 6 feet culvert; gneiss rock with quartz and feldspar; jungle.

4 miles 2 furlongs.—Village of Bânpûr. Dry and wet cultivation, undulating ground.

4 miles 5 furlongs 197 yards.—A stream 30 feet wide, 10 feet deep in flood, banks high, rock for foundation on one bank, broken ground, stony soil. A furlong further another small stream 9 feet x 3 feet, much rock about here; soil, clay with some kunker; jungle. The easy decline continues.

5 miles 3 furlongs.—Village of Peramara.—Traffic.—Ninety bullocks from Binka to Pârvatipûram with paddy. The ground is irregular, broken and undulating, but there is no obstacle to road or railway.

Three furlongs further a small stream needing a 6 feet culvert; some paddy-fields. Hill ridges to the right and left of the track, 3 to 4 miles apart, the hills rising upwards of 2,000 feet above this, well wooded, fit for coffee, tea and cinchona.

7 miles 176 yards.—Village of Boreguda. Some dry cultivation in the midst of jungle.

Traffic.—Pack bullocks from Pârvatipûram going northwards to bring grain.

The fall from the summit level to this is 220 feet in 3 miles 3 furlongs, or about 1 in 80. But this gradient can be eased by keeping on higher ground and throwing the foot of the descent a mile further out, whereby a gradient of 1 in 100 for a distance of 4½ miles may be obtained. This represents all there is, on this side, in the shape of a ghât. It is only the present track that descends somewhat rapidly (as the section will show) from the summit, but there is ample room, by taking the line on higher ground along the hill side, for an easier descent.

The ground is, on the whole, easy, and there will not be much hill side cutting required. 8 miles 1 furlong, the country now becomes flat again, the village of Bengon on the right, Kârgati on the left; near the latter a large pond or tank with wet fields under it; some dry cultivation surrounded by jungle, ground irregular and undulating, and cut up by gullies; soil, red clay.

9 miles 2 furlongs.—Boundary between the Bisemkattak (Jeypur) and Kālahundy estates, marked by heaps of stones where the line crosses the track. Dense jungle of trees and shrubs; matti wood plentiful; stony soil.

Sigrtgappa, the first village in Kālahundy territory; mud and thatch bungalow without windows. From here four tracks branch off, viz., to Lonjigar, Bondesor,* Asurgor and

* Via Santpūr and Dādpur.

Ombadōla. Forest of large trees; some good timber, especially matti, but little undergrowth.

10 miles 3 furlongs.—Stream, waterway 20 feet $\times$ 5 feet, high banks, gravel bed. The hill range on the left rises up to nearly 3,000 feet, and is well wooded; small nullah 10 feet $\times$ 5 feet; abundance of kunker limestone about.

11 miles 50 yards.—Stream 25 feet $\times$ 6 feet, stony bed, good banks, no rock visible; all jungle, no cultivation.

11 miles 5 furlongs 176 yards. Sorigura.—A few huts in a small clearing in the midst of a dense jungle. A kind of wild ginger grows here, the people use it medicinally to heal sores.

29th November, Sorigura to Asurgor.—Distance 10 miles 6 furlongs. Height of Asurgor above M.S.L. 699'; descent from Sorigura to Asurgor 228 ft. Distance of Asurgor from Vizagapatam 192 miles 7 furlongs. Heavy dew in the morning; thermometer at 6 a.m. 57° F. An armed man, sent from Lonjigar to my camp for assistance and carrying sword and hunting knife, led the way.

The track runs alongside of the Sandul stream through a dense forest of good timber trees, old and young; matti abundant, some yēgi, sāl and blackwood. An ample stock of timber for railway sleepers, &c.; soil, virgin.

1 mile 6 furlongs 117 yards. Crossed an affluent of the Sandul stream, 160 feet wide and 18 feet deep in flood; bed shingle and sand, banks high and low alternately, the lower side flooded in the rains. All virgin jungle and forest here, without a patch of clearing or cultivation for more than a mile. Here I heard the first jungle cock in these parts.

Village of Padmāra, with a large pond or tank; country flat; soil, light clay with sand. In the 3rd mile the jungle becomes lighter; some paddy-fields and dry cultivation; trees-ippa, matti, fig, tamarind mango, stunted date, gooseberry and other jungle trees.

Village of Poremallā.—Heavy soil; enter jungle again.

4 miles 1 furlong.—An irrigation tank newly constructed or repaired by the people of Bākel, a village a mile further north.

4 miles 7 furlongs 114 yards. Bākel. A largish village, wet and dry cultivation, paddy and sugarcane, horsegram, ragi, mustard, and gingelly; low hill ridges, east and west, 2 to 3 miles apart.

Olisirka.—The people's swamies or worshipping places here consist of a stump or block of wood let perpendicularly into the ground with its top rudely carved; scrub jungle, much stunted date, long coarse grass; dark, clayey soil.

6 miles 2 furlongs. Tulagaon.—Wet and dry cultivation. The villagers here possess more cattle than I have so far seen since Ryaguddah; the village pig is not wanting, nor the pariah dog. I have seen no donkeys for some time, nor dhobies. There is a good deal of open ground around this village; then scrub jungle again. The villagers here understand Hindustani, besides Oriya.

Half a mile further a pond or tank; irrigation is carried on under it as well as round its margin on three sides. Country comparatively open; good ground for a large camp; good grass, plenty firewood, water from the Sandul river close by, ample straw and grain, other supplies procurable. The large village of Norola to the right; heavy dark soil, no stone or rock.

Sorigura.—Wet and dry cultivation, numerous cattle.—There are carts here with solid wooden wheels, 4 feet diameter, made of three segments; wooden axles.

8th mile.—Nearing the village of Mandel, a tank, gardens of sugarcane, rice-fields, a few young trees planted, fenced in and taken care of. The village is of a good size and there is much cultivation all round; soil nearly black; country open. From here leads a track to Bhavānīpatnam (which is the popular name used about here for Bondesor).

10 miles 6 furlongs. Asurgor.—This village has been of some importance in former times, but is now insignificant. There is a large tank. The village is situated in a rectangular enclosure of earthen ramparts (an old fort) about one-third of a mile square, with a moat round it that can be filled from the tank. In the moat some paddy is cultivated, and red and white louts flowers grow extensively. A fine mango tope for camping, south-west of the old fort, just under its ramparts and near the moat. Near this tope will be the most suitable site for the future railway station.

Trees.—Tamarind, wild fig, ficus religiosa, mango, yēgi, ippa, sāl, matti, the wild silk cotton tree and other jungle trees; also several kinds of acacia, among them the tree (I forget the name) of which the bark is used in the south for the manufacture of arrack.—I have met no sandalwood as yet in the jungles.

30th November. Asurgor to Bogor.—Distance 12 miles 4 furlongs. Height of Bogor above M.S.L. 628. Fall from Asurgor to Bogor 71 feet. Distance of Bogor from Vizagapatam 205 miles 3 furlongs; from Raipur about 165 miles.

The Police Inspector and the Kotwal from Bisemkattak, who had accompanied the party so far and been very useful, the one in arranging for supplies and coolies and the other in acting as guide, returned from here. A Sowār mounted and armed and a minor official, sent by the Officiating Dewān of Bondesor to assist the camp, joined this morning.

Thermometer 6 a.m. 58° F.

Crossed the Sandul river, 19 feet deep and 170 feet wide in flood. Three 50-foot spans required. Rock for foundations of piers and abutments; gneiss mixed with quartz and conglomerate; kunker limestone near the spot.

Enter light jungle, with fields of dry cultivation here and there; soil, heavy clay, nearly black.

Village of Borgdon.—Open country around, extensive wet and dry cultivation, the former under a tank. There are no sluices in the bund of the tank; the water is lifted up by picotas into wooden troughs laid across the bund and so let into the fields below the tank.—There I saw wild geese and duck, some cranes, plover, white gulls, and the first brace of snipe since Parvatipuram. Cattle are numerous about here.—Rice is packed for carriage in bags (about a cubic yard in capacity) made of straw ropes worked together in a manner similar to rattan basket work.

Village of Selirpalli.—Some cotton was being cleaned here by the ordinary hand-machine (Charka). A tope of young mango trees, about 5 years old, is being attended to; extensive rice-fields; dry crops; gram, cotton, ragi, gingelly, castor-oil, mustard, chillies, beans, gourds, pumpkins, and tobacco.

Trees.—Bhēr, ippa, tamarind, mango, jack, fig; soil, lighter than before, more sand in it.

Village of Bōlaspur, with a tank. Then jungle again with a few patches of wet and dry cultivation; some rock. From here tracks lead to Bānpūr (N.E.) and Dādpūr (S.W.)

4th mile.—A small stream requiring a bridge 18 feet span $\times$ 9 feet high; sandy bed, good banks; jungle again.

Domsilāt.—Half a dozen huts in the jungle, with a few fields; then dense jungle on light soil; the sand on the track shining with small particles of quartz and feldspar, and dust of mica and pyrites.

Torta.—Five huts in a small clearing surrounded by jungle.

Six miles 7 furlongs, crossed the Dhēron stream, 65 feet wide between the banks which are 7 feet high and occasionally flooded to a further depth of 7 feet for some distance. Total width 162 feet, depth 14 feet. The railway would keep on the right bank of the stream, near Kohermāl, and cross a mile to the east of Kandel.

Korlakuta.—A dozen huts in a jungle clearing, with a few fields; then jungle; much kunker limestone is here lying about the surface.

Kandel.—A dozen huts in a large clearing in the jungle. A few rice-fields and some dry crops.

The river to be crossed a mile east of Kandel is 245 feet wide and 16 feet deep in flood, when the low banks which are about 8 feet high are covered to a further depth of 8 feet for some distance. The bed is sandy, no rock visible. Five 50-foot arches, crown 20 feet above deep bed, will be required. A few fields cultivated; then jungle again; soil, light clay with sand.

Danmormura.—A few huts in a small cleared space surrounded by jungle. A crude "still" for the manufacture of alcoholic liquor from the flowers of the ippa tree was at work here. There are very few fields about the place; jungle again.

Limpora.—Some open ground and a few fields; some sugarcane, then light jungle. A small nullah 11 feet $\times$ 4 feet. A tank with rice-fields under it; then Bōgor, 12 miles 4 furlongs.

1st December.—Bōgor. Thermometer 6 a.m. 47° F.

Mr. Cormac arrived from Bondesor; all well in his camp, except one lascar and one mahout who have fever. Mr. Cormac's report and notes of reconnaissance taken during his march, as well as a section of the country gone over by him, accompany this. We are busy with accounts, reports, maps, observation of instruments, calculations of altitudes, &c., and with general camp duties. The weather is fine; the nights are cold.

Fever begins to prevail in the camp; the Dresser, the Hospital Servant, the Writer, one Police Constable, three Lascars and several servants are laid up with it.

There is much white and reddish quartz about here; my camp stands on a bed of gneiss and quartz. A hill near this consists of the same minerals. There is also some porphyritic granite, with feldspar in large crystals, thickly scattered over the surface in white blotches, often rectangular in shape. The quartz is full of shining specks, white and yellow, leadlets that can be detached with a pen-knife, probably mica and pyrites, as well as glistening grains of some metal, and little nodules of peroxyde of iron embedded in the quartz. I will forward from Raipur a few samples, both pulverized and solid, for chemical analysis and assay, if it be considered worth while to have this done.

Despatched a messenger, one of the men from Bondesor, to the Zemindar at Kariāl, to see about arrangements for supplies, coolies, &c., en route to that place, as nothing seems to have been arranged so far by the Kariāl people, and without their authority nothing is to be had.

2nd December, Bōgor. Thermometer 6 a.m. 49° F.

Occupied with office duties, as yesterday.

3rd December, Bôgor. Thermometer 6 A.M. 49° F. Went out to examine the *Tel river* and to find a suitable crossing. The bed is treacherous and will in some places not support the weight of horse and man.

No *tappal* received in camp for more than a fortnight.

Bôgor,
4th December 1881.

(Signed) K. F. NORDMANN,
Executive Engineer on Special Duty.

IX.

MR. CORMAC'S REPORT.

18th November, camp Comelypettah; height 703 feet above M.S.L.
Distance from Ryaguddah, 5 miles 2 furlongs 176 yards.

At one-eighth mile crossed a river (50 feet $\times$ 9 feet) with stony bed, banks not well defined. Passed a Khônd village (Santal) 1½ miles from Comelypettah; from that village the country is broken by ravines; low jungle prevails and continues to Coormpettah, a large village principally of Telugu people.

The country here is well cultivated, soil light and sandy, the hills on the west are well wooded, and are about one mile distant. Camped at Dorabada, where there is a large area under them. There is a good camping ground beyond the village and a well of good drinking water. The land in the vicinity is fully cultivated and well irrigated; the villages round about, as well as this, are peopled with immigrants from the Kurupam taluk near Parvatipuram.

19th November, camp Dorabada; height 835 feet above M.S.L.
Distance from Comelypettah, 7 miles.

Difference in altitude + 132 feet.

Passed along the foot of the hills to the west of the valley through well-cultivated land (chiefly dry cultivation), the ground having a slight inclination to the east. About 3 miles from Dorabada the track crosses several deep ravines and much broken ground with patches of dry cultivation here and there. At 7¼ miles from Dorabada the track runs parallel with the Nágavully river, and crossing a large stream (138 feet $\times$ 8 feet, banks not well defined, bed stony) and good drinking water near the village of Shikarpoy; there is a good camping ground at this place, and the country round about is well cultivated; the rice crop which covered a large area has been harvested.

20th November, camp Shikarpoy; height above M.S.L. 992 feet.
Distance from Dorabada, 9 miles 1 furlong.

Difference of altitude + 157 feet.

The track from this village runs nearly parallel with the Nágavully river up to Singapore; the river valley is about 2 miles across, and the cross section is almost level. Fully two-thirds of the valley is under cultivation, chiefly dry crops. Four streams, one requiring a span of 15 feet, one of 16 feet, and two of 20 feet were crossed up to 3¼ miles from Shikarpoy. Here a large stream requiring a span of 30 feet was met with; the banks of this stream are not well defined, and the bed is stony.

The village of Narainpoornam (4 miles) possesses a small *pucka temple*, the first seen since leaving Ryaguddah. At 4½ miles distance a stream requiring a span of 40 feet was crossed, 30 feet, bed rocky, banks well defined; and at 5½ miles another stream requiring a span of 30 feet, bed sandy, banks not well defined.

At Singapore crossed the Nágavully, requiring a bridge of three openings of 40 feet each; of the country generally from Ryaguddah to Singapore is rice, ragi, cholam, sugarcane, horsegram, green-gram, gingelly, linseed, and hemp. The *trade* chiefly consists of the food-grains named previously and gingelly, castor-oil, hemp, linseed and hides; the track followed by me yégi, matti, ippa, mango, and blackwood. In the forests the timber chiefly found is jack.

At Singapore ordinary smiths and carpenters are obtainable, their hire being 4 and 5 annas per day, ordinary coolie hire is 1½ annas per man per day; this is generally paid in kind. The country is but sparsely populated, and there is space for a large number of immigrants, especially north and east of Singapore.

22nd November, camp Singapore; height above M.S.L. 997 feet.
Distance from Shikarpoy, 7 miles 2 furlongs.

Difference of altitude 5 feet.

Passed through the town of Singapore by the fort of the Rajah, a space enclosed by a mud wall about 12 feet high and 3 feet thick with a thatched coping; the buildings inside being of mud and thatched.

Beyond the town the country is open and under dry cultivation; over a large area the stumps of *sál* trees are still standing.

The track runs along the watershed of the San and Bodo rivers, until the San is crossed near Palkonianah; the banks of the stream which flows at the bottom of a deep ravine are not well defined, the bed is sandy, span required 70 feet $\times$ 10 feet.

At 5½ miles distant from camp another stream flowing at the bottom of a ravine is crossed, the bed is rocky, and banks not well defined; between these two streams lies the village of Palkonianah, round which there is a large area of dry cultivation. After crossing the stream the track enters dense jungle, and crosses several smaller streams, entering a clearing of about 6 acres near Tirmui, where there is a good camping ground and good water; the jungle is very thick, and it was with difficulty that the elephants passed through it.

23rd November, camp Tirmui; height above M.S.L. 1,602 feet.

Distance from Singapore, 10 miles 5 furlongs.

Difference of altitude + 605 feet.

On leaving camp, entered dense jungle which continued for 3½ miles, when the village of Naraindong was reached; the country from this place is well cultivated and under sugarcane, and rice quite up to Lonjigar, where a halt was made. Just before entering Lonjigar, the Bongsdara was crossed, banks are well defined, and the bed stony, requiring a span of 40 feet $\times$ 12 feet. The forest abounds with *sál*, yégi, matti, jack, mango, ippa, and blackwood trees; the soil is rich loam, except at the small gháts where it is rocky. The track is evidently not much used, and probably only the produce of the south of the Lonjigar valley is conveyed by this route.

The country from Singapore to Lonjigar is very thinly populated and there is ample room for a large number of immigrants. The crops produced are chiefly rice, ragi, gram, and sugarcane. There is a good camping ground, and good water obtainable.

26th November, camp Palkonianah; height above M.S.L. 1,158 feet.

Distance from Singapore, 4 miles 4 furlongs.

Difference of altitude 161 feet.

Skirted the side of a hill, through jungle, for five-eighths of a mile, passing south of the village of Chothopoor which is surrounded by wet cultivation; and at 1¼ miles passed through low jungle with a small patch of dry cultivation on the south.

At 1½ miles crossed low ground under paddy cultivation and entered the village of Moondeegoodah; here met hides coming from Junagar.

At 2½ miles joined the regular track of the Brinjarries from Singapore; this track lies on the watershed of the Bodo and the San rivers and has a very gradual ascent.

At 2½ miles distance crossed the *San river* (banks well defined, bed sandy, and requiring a waterway of 60 feet $\times$ 10 feet), passed up the valley (about half a mile broad and with an almost level cross section) of a small stream up to a low saddle, skirted the side of a hill, crossed a second saddle and entered upon a wide open valley (well cultivated) in which stands the village of Bijepur. The ascent to this is very gradual and might be made practicable for carts at a small cost. The track continues along the valley (ascent very gradual) which is broad and open and nearly level across up to spot marked *Nianpur* on the map, where the camp was pitched. Up to this the country from Bijepur is well cultivated, both wet and dry, the dry being chiefly lamp-oil seeds. The soil is a sandy, reddish clay, camping ground good, and good water procurable. The hills on each side of the valley are well wooded, and several topes of large mango trees were passed.

27th November, camp near Kundru; height above M.S.L. 1,757 feet.

Distance from Palkonianah, 9 miles 4 furlongs.

Difference of altitude + 599 feet.

Left camp, proceeding up the valley of the Kundru stream, which is crossed several times by the track (but which may be avoided) through dense jungle (which had to be cut to permit the passage of the elephants) to the head of the *Musa ghát*, which is 2,047 feet above mean sea level.

With the exception of the last furlong, the ascent is so gradual that the track may be made practicable for wheeled traffic for a small outlay, and no difficulty will be experienced in the last furlong. From the ghát head, on the Bondesor side, the gradient is very steep for 1½ miles to the foot, whence it runs with a gradual descent for four miles through dense jungle to the camping ground. Good water is procurable, and the camping ground is good.

Owing to the heavy jungle, it was not possible to see much; but from what was observed of the hills, the difficulties attending the opening out of a good ghát road, with a gradient of 1 in 22, will be very slight, as apparently little more than earthwork will be necessary.

28th November, camp Majigaon; height above M.S.L. 915 feet.

Distance from near Kundru, 6 miles 6 furlongs.

Difference of altitude 842 feet.

Left camp along the valley of the Patna river which was crossed about 5 miles distant, and proceeded nearly parallel with the course of the Simli Jor which was crossed near *Boheragura*, about 9¼ miles from last camp; all this distance was traversed through dense jungle, passing only two small patches of cultivation.

The village of Beheragura stands in an open piece of ground, but there is very little cultivation near it, and it has the appearance of being almost deserted. From thence the track continues through low jungle quite up to Bondesor, where there is an excellent camping ground; good drinking water has to be brought from a distance.

Between the foot of the *Musa ghât* and Beheragura there is a large area of land available for immigrants; the soil is good and fertile.

In the forest one matti tree was measured and found to be 13 feet in circumference, 6 feet above the ground; there is *sâl*, *jack*, *yâgi*, *ippa* and *mango* in any quantity, and also small bamboo.

Limestone is procurable (nodular kunker) in abundance; iron is found and worked in Bondesor, nearly every person met being armed with an axe of local manufacture.

The climate is said to be unhealthy, but with so much jungle this may be expected; the working season would be from November to July; the country would be difficult to travel in during the remainder of the year on account of the rains.

The chief trade is in rice, gingelly, Bengal gram and linseed; this is chiefly exported from Junâgar, the route to that place diverges to the west about 9 miles south of Bondesor.

Fully 600 Brinjarries' pack-bullocks were met from Junâgar this day with rice and Bengal gram, and about 200 (empty) on their way to the same place.

A few bricklayers, carpenters and stone-cutters, live at Bondesor, and are said to receive 8 annas each per day; judging from the description of the buildings in the town, very few have been employed, as only two tiled houses were seen, besides the house of the Rajah, which is of brick in clay, but is incomplete.

The jail is a wattle-and-daub structure with a thatched roof; the prisoners (about 90) are employed in making roads; a few also make carpets.

A kind of cloth resembling Tassa silk is manufactured in this part of the country. It was ascertained that rice is being sold in Bondesor at 50 seers per rupee, and at Singapore only 32 miles distant at 12 seers per rupee; this fact shows the necessity for improved means of communication between the two places.

The Acting Dewan of Kulahundy was exceedingly attentive and gave every assistance in his power; without his help it would have been very difficult to obtain supplies, as the villages passed are small and do not possess any bazars.

30th November, camp Bondesor; height above M.S.L. 729 feet.
Distance from Majigaon, 11 miles 3 furlongs.
Difference in altitude 186 feet.

Proceeded through the town of Bondesor, emerging from it at three-fourths of a mile from starting point. From limit of town to 2 miles passed through wet cultivation and thence through a well-cultivated country to Bijepur, 5½ miles distant from Bondesor. From this place the country has a most deserted appearance, land previously cultivated having been abandoned.

At 7½ miles passed through the village of *Dâdpûr*, consisting of about 200 thatched houses and with a small area under cultivation near the village. The country is partially cleared of jungle where not cultivated, and heavy jungle is not seen except on the hills.

At 8½ miles beyond *Dâdpûr* crossed a small ghât, through thick jungle, and at 4½ miles crossed a river with sandy bed and well-defined banks, requiring a waterway of 80 feet x 15 feet.

There is a good camping ground and good water at Komâri; country more or less rocky.
1st December, camp Komâri; height above M.S.L. 558 feet.
Distance from Bondesor, 13 miles 5 furlongs.
Difference of altitude 171 feet.

On leaving Komâri, passed through patches of cultivated land, surrounded by partially clear jungle; the appearance of the country here gives the impression that it has been more populous, but has been deserted, there being traces of cultivation all along.

At 2½ miles crossed a stream with stony bed, and banks not well defined, requiring a waterway of 50 feet x 6 feet.

Up to 3¼ miles passed through country covered with long grass, at *Jurang*, (8½ miles) where patches of cultivated land and partially cleared jungle continued to 5½ miles, up to the village of *Uthekela*, round which also is some cultivated land.

At 8½ miles passed the village of Boria, on high ground; open country all round, and wet cultivation to east.

At 9½ miles crossed a river, the *Ret Noi*, with sandy bed and well-defined banks, requiring a waterway of 250 feet x 15 feet.

At 13 miles 2 furlongs reached *Bôgor*; height above M.S.L. 628 feet.
Along the last five miles of this journey a tolerably level road was traversed, without any surface covering of gravel or metal, but with side drains and recently planted avenue trees at intervals; this road runs from Bondesor to Sumbulpoor, and is said to be fairly practicable for carts.

Bôgor,
4th December 1881.

(Signed) J. CORMAC,
Sub-Engineer.

(Signed) K. F. NORDMANN,
Executive Engineer on Special Duty.

X.

From K. F. NORDMANN Esq., Executive Engineer, on Special Duty, to the Secretary to Government, Public Works Department, dated Raipur, 6th January 1882, No. 24-R.

Submits Report of Reconnaissance from 5th to 30th December, with Sections.—I have the honor herewith to submit the report on the reconnaissance from Bôgor to Raipur (5th to 30th December 1881), together with an extract from my notes taken *en route*.

The sections will follow in a few days, *i.e.* as soon as all the aneroid observations, taken on the coast up to date, have been received. I request that all the altitudes, entered in my previous reports, may now be corrected according to the figures given in the sections, which are final and accurate.

2. *March from Bôgor to Onki.*—The party crossed the *Tel Nadi* near Bôgor on the 6th December, and marched along the left bank of the *Sunder river*, via *Bodka-podôr*, *Badbeng*, *Tâkla*, *Kariâl*, *Kolinga*, *Kunnûna* to *Torhor*, thence across a low watershed and through some very dense jungle, via *Kandamuri*, *Sialjôri* and *Jalbal*, into the valley of the *Jong river*, and along its right bank to *Onki*.

3. *From Jalbal to Raipur.*—Returning from *Onki* to *Jalbal*, the reconnaissance was continued via *Nara*, *Sûarmâl*, *Kopli*, *Patrapâli*, *Telibanda*, *Umarda*, *Mahâsamund*, *Kharôra* and *Belsôra* to *Gorari*, where the *Mahânadi* was crossed; thence to *Arang*, where I halted a few days to give the people and cattle some rest, and then along the *Sumbulpoor road* to *Raipur*, the distance of which from *Vizagapatam* by this route is 372 miles.

4. *Crossing of the Mahânadi.*—*Gorari* is the best place to cross the *Mahânadi* about here, as the banks are well defined, and the river is not so wide as in the adjoining reaches above and below.

There is a still better crossing near *Lound*, some 50 miles north-east of *Arang*, but it is too far away from this line.

5. *General character of the line.*—The ground traversed all the way from *Bôgor* to *Onki*, and from *Jalbal* to *Raipur* has been, practically, almost level; that is to say, the slopes have been very easy, and the gradient need never exceed 1 in 100. *Bôgor* is 628 feet and *Raipur* 962 feet above sea level.

The greatest elevation reached between the two places is at *Bagbâhra*, viz., 1,084 feet; while *Onki* is 899 feet above mean sea level. The entire route is perfectly easy, there is no obstacle of any sort for either road or railway, and there are only three large rivers to be crossed, named the *Tel Nadi*, the *Jong* and the *Mahânadi*.

6. *Building materials, labour, soil, wet and dry crops.*—Building materials, such as stone, timber, clay and sand, limestone and iron, are abundant; and labour is to be had to such an extent as the somewhat sparsely populated jungles will admit.

The soil is rich throughout; rice and sugarcane, besides the ordinary dry crops, are grown along the whole line; the irrigation expedients for the wet crops being of the most primitive kind, yet quite efficient.

7. *Recommends that the line via the Musa Ghât and Bondesor be finally rejected.*—I have already recommended (in my letter No. 20-B, dated 4th December 1881, paragraphs 4 to 6,) that the line via *Bondesor* may be rejected for the purposes of the proposed railway, owing to the obstructions offered by the *Musa Ghât*; likewise the *Lonjigar line*, on account of the high elevation attained (upwards of 1,600 feet) at *Tirmui*.—Hence, if the railway is to be taken east of the *Noagarh hills*, the *Ombadôla line* seems the best.

8. *A line from Asurgor to Sônpoor and Sumbulpoor.*—It is apt to strike any one looking at the map that, having arrived at *Asurgor*, this line seems naturally to trend in a northerly direction to *Sônpoor* and *Sumbulpoor* (crossing the *Tel Nadi* near *Turla*), rather than to *Onki* or *Raipur*. *Asurgor* is about 125 miles from *Sumbulpoor*, nearly the same distance from *Onki*, and 180 miles from *Raipur*; so that by joining the *Chattisgarh line* at *Sumbulpoor* or *Onki*, instead of *Raipur*, a saving of 55 miles could be effected. But, so long as it is not definitely settled whether the railway from *Nandgaon* (the present terminus of the *Nagpur-Chattisgarh line*) is to come to *Raipur* at all and cross the *Mahânadi* twice, at *Arang* and *Sumbulpoor*, or to go to *Bêlaspur*

without crossing the river, it seems premature to discuss the merits of a line from Asurgor to Onki or to Sumbulpoor.

9. *The route recommended by the Commissioner of the Chattisgarh Division.*—As regards the route travelled over by the Commissioner, Colonel Lucie-Smith (alluded to in the papers which accompany G.O., No. 3025 W., dated 5th December 1881), that portion of it from Bondesor to Polsodar may now perhaps be left out of consideration, since the railway is not intended, I think, to cross the Músa Ghát, and consequently will not touch Bondesor. From Polsodar to 5 miles north of Torbor, a distance of about 30 miles, the route traversed by the Commissioner coincides with my line; as does also that portion from Mahásamund to Raipur, another 30 miles.

The only part of the route, where his line deviates from mine, is that between Tarnot and Mahásamund, about 45 miles; his line going from Torbor via Límidi, Tarnot, Sarabong, Tendubarra, Sirgidi, Bodrabanda, Kamaria and Karti, while mine (which may be 5 miles longer than the former) proceeds via Sialjóri, Jalbal, Nara, Súarmál, Bagbáhra, Patrapáli, Telibanda and Umarda to Mahásamund.

10. *Objections to the above route.*—Although the line travelled over by the Commissioner may be unobjectionable for an ordinary cart road, yet for the purposes of a railway there are two obstructions in the way. These are a small ghát 2 miles south of Tarnot, between that place and Góbra, and a heavier ghát at Sirgidi, where Colonel Lucie-Smith says that he had attained an altitude of 1,500 feet. These two small gháts, I consider, offer sufficient grounds for rejecting that line for a railway, when an easier line without any ghát is available by making a slight détour.

I was informed of the Tarnot and Sirgidi line by the Rajah of Kariál, (as mentioned in my notes, dated 9th December), but from the description I heard of it I did not consider it a suitable line for a railway, and hence did not reconnoitre it.

11. *Faulty Tappal arrangements at Ryaguddah, and delay in receipt of telegram, dated 1st December.*—If I had received G.O., No. 3025 W., dated 5th December 1881, and your telegram, dated 1st December, in time, I should nevertheless have examined this line; but the tappal arrangements made at Ryaguddah were very faulty.

No letters or papers reached me for nearly six weeks, i.e., from 14th November to 23rd December, on which date the printed Government Order, alluded to, containing your telegram, was delivered to me. This was the first intimation I had of the despatch of that telegram. A copy of the telegram, posted at Madras on the 1st, which had been to Ryaguddah and thence returned to Vizagapatam, reached me only on the 26th December at Arang. I had then left Bondesor, 150 miles behind me; and, looking to the work still to be done between this and the hot weather, and the uncertain state of the health of my establishment, I thought I should not be doing the right thing if I turned back, or sent Mr. Cormac back, the more so since I had already pronounced against the line in question.

12. *Consultation with the Chief Commissioner, Central Provinces, and the Commissioner, Chattisgarh Division.*—I went to see the Chief Commissioner of the Central Provinces, Mr. Morris, who was here on tour, and the Commissioner of the Chattisgarh Division, Colonel Lucie-Smith, as soon as I reached Raipur on the 30th, and explained my views with regard to the Músa Ghát and the route via Tarnot and Sirgidi; and I believe both these gentlemen agree with me that, although the latter route may be very suitable for a road, it is objectionable for a railway, on account of considerable ascents and descents and the high altitude attained, while there is an easier route running parallel to it which is but very little longer.

13. *Readiness of Native Chiefs to forward the post.*—I do not know who is to blame for the faulty tappal arrangements at Ryaguddah. I believe the Sub-Magistrate there had orders from the Collector of Vizagapatam to forward the post after me, and I instructed him to despatch a post twice a week; but he only did so until I reached Ombadola, not after that; although the Tāt Rajah at Bisemkattak and the Zamin at Ombadola were quite prepared and willing to send letters to follow me as far as Kariál; while the Bondesor Ráni would have sent them on to Raipur, if necessary. A Bondesor Policeman actually walked 120 miles through the jungle in four days and brought me a letter (*vide* "Notes," dated 20th December), which had

been sent by the Commissioner of Chattisgarh Division via Sumbulpoor, and had been delayed en route.

14. *Traffic along the route.*—On the whole I have not met much bullock traffic on the route traversed; but this may be owing to the season, just after the monsoon, when the crops have only just been harvested. However, from my own recollection, the traffic from Raipur, Nagpur, and Bustar, via Jeypur and Potinghy, and down the several gháts in that direction, is very much heavier than by this route.

15. *Acknowledgment of assistance rendered to the party.*—I have to record my obligations to the Jeypur Rajah's Amins at Ryaguddah and Ombadola, the Tāt Rajah at Bisemkattak and his Kotwal; the Police Inspector of Bisemkattak; the headman of Bógor village; the Ráni of Bhavanipatnam (Bondesor), her Dewan and other officials; the Rajah of Patna; the Rajah of Kariál and his most obliging Police officers; and the Zamindars of Nara and Súarmál, for their readiness to assist the reconnoitring party in every way, with information, guides, coolies, camp supplies, &c. Without their willing aid it would have been very difficult indeed to traverse those wilds. Even so it was sometimes very trying work to push on, without unnecessary delay, through almost trackless jungles, with such a large camp, the sick having to be carried in improvised dhoolies; but we managed to push through without losing a man, and attended to our survey. Mr. Sub-Engineer Cormac has given me most valuable assistance during the whole journey, and the Hospital Assistant, P. V. Ramaswamy Naidu, has looked well after the sick.

16. *Another set of Ordnance Maps asked for.*—I beg to request that another set of ordnance maps (scale 4 miles to the inch), comprising the sheets containing Raipur, Sumbulpoor, Jeypur, Vizagapatam and the intermediate country, may be mounted in one large map on rollers (similarly as I have had the first set mounted), so that I may on my return mark thereon the lines traversed and the exact location of the proposed railway by the several routes; since the map with me is somewhat the worse for wear, and I have only been supplied with one set of maps, but not with the duplicates, as mentioned in paragraph 8 of G.O., No. 2294 W., dated 16th September 1881.

17. *Two more Aneroids wanted.*—I also request that two fresh aneroid barometers may be sent to Nárangpur, to await my arrival there; as two of my aneroids have become unreliable.

18. *Letters how to be addressed.*—Letters despatched after the 15th instant should likewise be addressed to "Narangpur, care of the Postmaster, to await arrival." I have made arrangements for letters to be sent after me from Raipur as far as Noagarh.

19. *Proposed details of reconnaissance from Raipur southwards.*—The reconnoitring party will leave Raipur in a few days, as soon as all the office work that has to be done is disposed of. Mr. Cormac's party will march via Dhamtari and Kankér through a corner of Bustar, via Banskót to Omorkót, while I shall proceed via Rajim, Kopra, Paregón and Noagarh to Ruigarh and Omorkót; thence we march together to Narangpur where I expect to be about the 8th February; reaching Kuraputi about the 14th idem. At Kuraputi I propose to halt a week or ten days to bring up arrears of reports, sections, &c.

20. *The Revenue subordinate not yet joined.*—A Revenue subordinate (as provided for in paragraph 15 of G.O., No. 2294 W., dated 16th September 1881,) has not yet joined the reconnoitring party.

The Agent at Vizagapatam states, under date the 2nd December, that he has been unable to find a qualified gumastah, and that he has telegraphed to the Agent in Ganjam to send me a man who knows the necessary languages.

Nothing further has been heard on the subject.

Meanwhile I have had to employ two inferior men, one from Párvatipuram, the other from Ryaguddah, who between them share the pay intended for the qualified gumastah; one of these men is attached to Mr. Cormac's party and one to my own.

XI.

Extract from Notes of Reconnaissance, from 5th to 30th December 1881.—Bogor to Raipur, distance 166 miles.

Bogor, 5th December 1881.—Thermometer 6 A.M., 48°; 10-30, 65°; 4 P.M., 77°. Despatched one camp ahead.

Received a letter from the Officiating Dewan of Bondesor, saying that a Parwana (order) from Sumbulpoor, dated 14th ultimo, to render assistance to the party, had reached him only on the 1st December, and that Her Highness the Maharani had directed him to send orders along the route to Kariál accordingly.

The Dewan sent a specimen of a metallic ore, found near Bondesor, containing antimony and graphite; he also sent some rose-coloured stones (probably spinel rubies) found near Manjher. Among the fruit, vegetables, pastry, &c., politely sent by the Maharani of Bondesor, were some very delicate leafy cake of the finest texture, some sweet large yellow oranges with loose coats, besides tomatoes, radishes, knoll-kohl, yam, spinage, and large brinjals the size of melons.

The Dewan and the young Rajah's tutor are the only English-speaking persons in Bondesor. The Rani and her officers and Policemen have been most attentive in providing camp supplies, guides and coolies.

From Bogor to Kariál.—Distance 38 miles, 3 furlongs.—December 6th, Bogor to Bodkapodór.—8 miles, 7 furlongs. Thermometer 6 A.M., 50°; 11 A.M., 77°; 4 P.M., 78°. 1 mile, 5 furlongs; bank of the Tel Nadi.—We had to wade through the river, as the sand was too soft and yielding for riding. The river from bank to bank is 1,660 feet wide and 20 to 25 feet deep between the banks; but these are flooded in heavy monsoons to a further depth of 5 feet at least, so that the bridge would have to be quite 35 feet above the deep bed. On one bank there is rock visible which probably extends across the river not very deep below the sandy bed.

2 miles, 7 furlongs, village of Mohda.—Wet and dry cultivation. Soil.—Heavy clay, with some sand and some gravel. Crops.—Cotton, gram, gingelly, lamp-oil, castor-oil, ragi, mustard, tobacco, vegetables, paddy and sugarcane.

Dungripura.—Some dry cultivation; country open. Goutabali.—Like most of the villages here, built upon a high and dry site. The ground is somewhat undulating; the open country with its scattered trees has a park-like appearance; there is a little light scrub jungle; good grass land. Serko.—Fine, open country; high and dry ground; hard soil; many trees about. 6 miles, 106 yards.—A stream flowing into the Sunder river. This stream is not marked on the map. It is 9 feet deep and 50 feet wide in flood; high banks and sandy bed; no rock visible. Open grass country, with some trees and shrubs, and some cultivation. Half a mile further, the large village of Udepur.

There is a peculiar temple here, and another at Gurár, a little further on. The structure is built of stone in the shape of a flask with broad stopper; or a limekiln with a crown or cap; about 20 feet high, with the greatest diameter 8 feet, and a door 2 feet x 5 feet. The top ornament, resembling the stopper or cap, is a single flat stone carved at the edges, about 5 feet in diameter and a foot thick. 7 miles, 3 furlongs, Gurár.—Large village; fine tanks; sugarcane, rice and dry crops; much garden cultivation by means of numerous wells, 3 feet in diameter, 15 to 20 feet deep, worked by a kind of piecta; the mouth of the well mostly unprotected. Soil, light.

8 miles, 7 furlongs, Bodkapodór.—Good camping ground. Light sandy soil. A rich metallic ore crops out in masses above the surface, containing much pyrites, mica, iron; and to all appearance copper, antimony, bismuth, arsenic, traces of silver, and probably gold. Specimens will be sent from Raipur.—Height of Bodkapodór above mean sea level, nearly the same as Bogor, viz., 618 feet.

Distance of Bodkapodór from Vizagapatam 214 miles; from Raipur about 151 miles. The country is better cultivated here; the villages are larger, and there is less jungle about than I have met hitherto since leaving Ryaguddah; the people are more civilized too, they stipulated for payment for labour, supplies, &c., beforehand, whereas further south they were satisfied with what they received, and frequently did not ask for payment, sometimes even refused it when proffered.

December 7th.—Bodkapodór to Sorman.—Distance 11 miles, 7 furlongs. Thermometer 6 A.M., 53°; 11 A.M., 81°; 4 P.M., 79°. In the first mile a stream, from which a small irrigation channel is taken off. Bed sandy, one bank high, the other low, alternately; no rock visible; greatest width and depth in flood 110 feet and 9 feet respectively. 2 miles, 7 furlongs, 116 yards, Kuland.—A large village, with extensive cultivated fields, both wet and dry.

The country open, no jungle here; a nango tope near the village; also two tanks, one large, the other smaller. The country here looks prosperous, and the people (who are dressed to some extent) look well-to-do.

* Somewhat like the tombstones in the cemetery of Sertari.

Almost all the ground, except the hill sides, is cultivated; there is scarcely any waste land to be seen in the plain.

After this the ground rises and becomes undulating; there is less cultivation, and some light scrub jungle.—At 4 miles 2 furlongs, there is a sheet rock composed of a kind of conglomerate with metallic lustre and traces of iron and copper.

Kunkur limestone is found all over the country.

The railway line from Bogor should hug the northern bank of the Sunder river, keeping an average distance of half a mile or so from it, as the ground further north rises rather rapidly towards the hills and is undulating and in places somewhat irregular.

Gondergura.—Village with a large tank; rocky hillocks dotted about.

5 miles, 2 furlongs, 144 yards.—A stream with perpendicular banks, 8 feet high, and sandy bed; no rock. Width and depth in flood 110 feet and 7 feet, respectively.

Village of Daiton, small; little cultivation; some jungle; hilly and undulating ground; soil, dark clay.

7 miles, 4 furlongs, Village of Itcheqáon.—Wet and dry fields; soil, dark clay with some sand. Open, flat country.

Then a tank.—Then the village of Porsasopa, with tank and tope; light soil; good camping ground.

All the villages about here are built on rising ground. Ground slightly undulating.

9 miles, 3 furlongs, Bálbeng.—Large village; there are weavers here.

11 miles, 7 furlongs, Sorman.—A small place, at the foot of a hill; supplies scanty. Much wet cultivation in the lower grounds towards the river. Height of Sorman above mean sea level 638 feet. Distance from Vizagapatam 226 miles 2 furlongs; from Raipur about 139 miles.

A Policeman from Bishapatnam (on the map called Sindikola) 2 miles from here, belonging to the Patna Zemindar's establishment, came to see about supplies, &c.—Much fever in camp; ten to twelve people more or less laid up with it; some have to be carried on the elephants and in dhoolies.

One of the large tents from Coimbatore (that had been blown down in the rains at Bisemkattak, had one pole and the ridge piece broken and was temporarily repaired at Ombadola) got out of order again, and the ridge piece required further repair before the tent could be pitched.

8th December.—Sorman to Tukla.—Distance 10 miles 1 furlong. Thermometer, 6 A.M., 52°; 11 A.M., 78°; 4 P.M., 77°.

1 mile, 6 furlongs, Bishapatnam.—Large village belonging to the Patna Zemindar.

Police station.—Open country, well cultivated; dark clayey soil, rock cropping up in several places; gneiss, decayed near the surface; and conglomerate.

3 miles, 7 furlongs, 125 yards, Sálburut.—Large village with broad fields; a tope, good camping ground.

5½ miles, Jhotop.—Wet and dry fields; large gardens with wells; tank, tope and camping ground; soil gravelly.

A remarkable hill of white quartz half a mile south of the village; also quartz in large masses cropping out in several places; the village stands on quartz; the large reef, of which these outcrops evidently form part, runs from north to south.

6 miles, 7 furlongs, Boslar.—Some cultivation, and some waste land with light scrub jungle.

8 miles, 1 furlong, The Budan stream, with low banks and sandy bed; width between banks 145 feet, depth 6 feet, which depth during high floods, when the banks are overtopped, increases to 13 feet; the width during such floods is not easily ascertainable; the country around is then flooded by water of the Sunder river which is quite near.

10 miles, 130 yards, Tukla.—Large village with tank and topes; open flat country, good camping ground for a small army; light soil; water from wells, tank and river. Supplies procurable.

Two officials, sent by the Zemindar of Kariál, were here to attend to camp supplies, &c.

Height of Tukla above mean sea level 686 feet; rise from last camp 48 feet.

Distance of Tukla from Vizagapatam 236 miles, 2 furlongs; from Raipur about 129 miles.

The people here speak Maráthi, Hindí, and Oriya.

There are many weavers in Tukla and the neighbouring village of Risga, making a coarse cotton cloth; as well as Tassa silk, which sells here for about 6 annas a yard.

December 9th.—Tukla to Kariál.—Distance 7½ miles. Kariál is the largest village met with since Párvatipúram; it is said to have 400 houses and about 2,000 inhabitants.

The Zemindar or Rajah of a large estate resides here.

Thermometer, 6 A.M., 52°; 11 A.M., 72°; 4 P.M., 77°.

1 mile, 183 yards, Risga.—Large village where Tassa silk is manufactured; open country; wet and dry fields; topes and trees; then some scrub jungle. The railway must continue to keep near the river bank, as far as San Doil, as the ground to the north of the river is high and irregular.

2½ miles, Pokansor.—Wet and dry cultivation as before; black soil; numerous cattle.

3½ miles, Boro Doil.—Soil, rich dark clay. Then San Doil; some light jungle.

At 5 miles 3 furlongs, a large tank, near the village of Ránpur, constructed by the Rajah of Kariál, upon springy ground; the drainage from the hills being excluded. The tank is for drinking water only; there is no irrigation from it.

It measures about 500 feet square and is 6 feet to 9 feet deep.—Here the Rajah's son, a fine young man of 24 years, richly dressed, with a younger brother, and a retinue of a dozen armed

men, some well mounted and in becoming native costume, and some on foot in red coats of the 16th Regiment, met us and escorted us into the town.

7 miles, 4 furlongs. *Kariál*.—Distance from Vizagapatam 243 miles, 6 furlongs, 116 yards; from Raipur about 127 miles.

In the afternoon we visited the Rajah Padmanabha Singh, who is a polite and pleasant elderly gentleman, somewhat infirm. His son had come to camp to invite and escort us. The Rajah has horses and elephants and keeps 40 sepoys; there is a small menagerie, in which besides other animals a large tiger is kept. The Rajah's house is in the native style, not an imposing edifice; near it is a small flower garden after the English pattern. There is only one person here who speaks English: a Baboo from Calcutta, who is Tutor, Secretary, Interpreter, Gunastah, &c.

The last European who has been here was the Deputy Commissioner from Raipur, eight months ago; he is again expected in February. The Commissioner is said to be on his tour from Raipur, via Sambalpur, to Boudoor, where the Rani has received notice of his visit.

The Rajah Padmanabha Singh expressed himself pleased with the prospect of a railway through his country.

Trades and manufactures.—There are carpenters, blacksmiths, and weavers (both of cloth and silk) in Kariál; also jewellers, gold and silver smiths, tailors, dhobies, and barbers; but no shoemakers; saddlery, shoes, boots, sandals, &c., have to be procured from Raipur by those who use them.

There are good sized donkeys here, the first I have seen for a long time; also crows, which are not found in the small villages in the jungle I have passed through. There is a local Post Office belonging to the Rajah's establishment. Letters are said to take ten days to reach Raipur; one man takes the post right through.

The ordinary traffic route to Raipur lies via Kumuna, Torbor, Tarnot (here called Khóla), Sarabong, Sirgidi, Charbatí, Kamariá, Kári (Police Station and local Post Office), Mahásamund, Gorári, and Arang.

By this route it is reckoned an eight days' journey from here to Raipur, at the rate of 15 miles a day, or about 120 miles; by the proposed railway line it will be but little (perhaps 5 miles) more.

The railway cannot conveniently follow the ordinary traffic route, because the latter crosses two gháts, one 2 miles south of Tarnot, and the other near Sirgidi.

Height of Kariál above mean sea level, 802 feet.—Rise from Tukla, 116 feet. Distance of Kariál from Vizagapatam 243 miles, 6 furlongs; from Raipur about 125 miles.

19th December.—*Kariál*.—Thermometer, 6 A.M. 52°; 11 A.M. 68°; 4 P.M. 78°. I despatched one camp to Tikali, 12 miles ahead. In the afternoon the Rajah Padmanabha Singh (who succeeded his elder brother on the Musnud some sixteen years ago) and his son came on an elephant to visit me. We had some friendly conversation; the Rajah again expressed himself pleased with the prospect of a railway, and asked whether Kariál would be a station, where the station would be located, &c. His son asked questions about the fate of the unfortunate Rajah of Pooree, who was tried and imprisoned last year and who is a friend of this family. The Rajah ordered his officials to pay every attention to the wants of the expedition.

The ridge pole of the large Coimbatore tent, which had been broken and repaired at Biseinkattak and Sormon and was again in want of repair, was here renewed during the night by the Rajah's order. There are ten to twelve fever cases in the camp.

The large Vizianagram elephant has sore elbows from kneeling down on stony ground when being loaded and unloaded.

Kariál is prettily situated and presents a fine oriental picture, especially when viewed from the west. The Rajah's modest palace, with its enclosure and small cupolas, the adjoining sheets of water with date and coconut palms along their banks surrounded by green fields, form a pleasing scene.

11th December.—*Kariál to Tikali*. Distance 11 miles, 7 furlongs. Thermometer, 6 A.M. 60°; 12 noon 87°; 4 P.M. 71°.

Outside of Kariál the jungle begins again, chiefly low scrub jungle with scarcely any cultivated fields for more than 2 miles. At 2½ miles the village of Chindagura, with extensive garden cultivation, mostly castor oil and tobacco; a few fields, both dry and wet. They have good cattle here, especially fine black buffaloes of large size. At the 3rd mile a stream 25 feet × 6 feet; soil swampy, banks not well defined.

3 miles, 4 furlongs. *Tonkpalí*.—Very little cultivation; some margosa trees, the first seen for the last hundred miles or so. Then jungle again, which in some parts is very heavy.

5 miles, 5 furlongs. *Kodjé*.—Much garden cultivation; castor oil, mustard, curry vegetables, beans, pumpkins, hyacinths, gourds, and tobacco; in the fields Indian corn, millet, cholam, and cotton; iron is manufactured here. Then some heavy jungle. A small nullah requiring a culvert 5 feet × 5 feet.

7 miles, 1 furlong. *Nnapára*.—A stream 20 feet × 6 feet close to the village is dammed up and utilized for rice-fields. Gardens and fields. Jungle again. Kankur limestone everywhere abundant.

8 miles, 192 yards. *Borgdon*.—There is a small furnace at work here for smelting iron ore; the ore used is a brown hematite; it is pulverized before being put into the furnace and then smelted with charcoal. There are also potters making pots and chatties in this village.

A quartz reef crops out near it; indeed quartz is found in many places along the whole route travelled over, and much of it seems to be more or less auriferous.

The soil here is light and contains much gravel. The railway should keep near the river bank, because the ground to the east is high and undulating. Light scrub jungle and high grass. Some matti wood and stunted teak.

In the 9th mile three small streams, averaging 12 feet in width and 5 feet in depth. Light jungle.

Shardéra.—Light jungle; swampy ground; some rice-fields; a field with hemp or nara. 10 miles, 5 furlongs. *Kolings*.—The low Nogarh hills visible on the left are well wooded; so also are the hills around this village.

11 miles, 7 furlongs. *Tikali*.—A few huts in a jungle clearing.—Half the lascars are laid up with fever; also several servants and some of the men belonging to the pack bullocks.

The Rajah of Kariál sent me some flowers from his garden, the first garden flowers I have seen since Párvatipúram.

Height of Tikali above mean sea level 761 feet; fall from Kariál 41 feet. Distance of Tikali from Vizagapatam 255 miles 5 furlongs; from Raipur about 115 miles.

Fair camping ground; drinking water from the river. No wells; they have been very rare along the entire route, so far.

12th December.—*Tikali to Kumuna*. Distance 10 miles, 3 furlongs. Thermometer ... { 6 A.M. 60½°; 11 A.M. 80°; 4 P.M. 81°.

Hilly jungle, stony soil with gravel, much quartz all about. 1 mile, 6 furlongs, 112 yards. Stream 30 feet × 10 feet, high banks, rock for foundation.

Village of Lámpáni; a little cultivation. Jungle, with much stunted teak. 3rd mile.—A stream 26 feet × 6 feet; much rock in the bed; ledges of stratified gneiss dipping at an angle of 45°, with conglomerate and quartz, extend across the stream. Jungle, rocky and stony soil. In the 4th mile, two small streams, one 6 feet × 4 feet, the other 10 feet × 5 feet.—Hilly jungle.

4 miles, 4 furlongs, 128 yards. *Village of Jalkusum*.—The railway here should keep close to the bank of the river; soil, dark and rich. A small stream, 15 feet × 5 feet, with a rocky bed.

5 miles, 7 furlongs, 115 yards.—Stream 36 feet × 9 feet; rocky bed, high banks; jungle. Here we join the Brinjarries' track from Raipur to Kariál, Dádpúr, &c.

6 miles, 6 furlongs. *Dumribahal*.—Met some 300 pack bullocks carrying gingelly seed from Raipur to Párvatipúram, Pallakonda and Nowpanda, whence they intend to bring up salt. Less jungle, and some cultivation.

7 miles, 5 furlongs. *Bilinjar*.—Tope, gardens and fields; tank, wet and dry cultivation. Jungle again on hilly ground, some very dense jungle through which a broad track 20 to 30 yards wide has been cleared for some distance.

10 miles, 3 furlongs.—*Kumuna*.—A large village, with a stone temple.—Kumuna was formerly the capital of the Kariál estate, and the late Rajah lived here; it was abandoned as a residence in favor of Kariál owing to a severe outbreak of cholera, from the effects of which the Rajah died.

Height of Kumuna above mean sea level 857 feet; rise from Tikali 96 feet. Distance of Kumuna from Vizagapatam 266 miles; from Raipur about 105 miles.

13th December.—*Kumuna to Torbor*. Thermometer ... { 6 A.M. 52°; 12 noon 83°; 4 P.M. 80°.

Distance 12 miles, 2 furlongs, nearly all through jungle. The Kariál estate on this side consists of little else than jungle, with scarcely any inhabitants. The soil is rich almost throughout; there are hundreds of square miles that might be made to produce fine crops of wheat if the country were colonized.

At the 7th furlong, crossed the *Gurmai stream*, 60 feet wide, 15 feet deep, just below its junction with a smaller stream; one bank high, the other low, alternately; bed sandy, no rock; jungle on rich dark soil.

Site of the village of Gursor which has been deserted (so it is said) on account of the Brinjarries having troubled the inhabitants too much for labour and supplies. Open country; grass land with some light jungle.

Village of Kisana; some dry and wet cultivation. *Site of the village of Tókápára*, deserted; jungle, grass 5 to 7 feet high; no track; rich, dark soil.—Here I saw the first partridge on this trip.

4 miles, 5 furlongs, 171 yards. *Kurisor*.—A small village; some wet and dry cultivation; soil, rich clay, nearly black.

5 miles, 3 furlongs. Stream, 36 feet × 7 feet, high banks, sandy bed, no rock.—The ruins of an old tank.—The country bears evidence of having been more thickly populated in times past.—Grass jungle, the grass 6 to 8 feet high; track barely visible; ground full of holes owing to the cracking and bursting of the dry black soil.

Koirbari.—A few huts. Some open ground, with a little cultivation; then dense jungle.
8th mile. Jondamara.—A deserted village, the people having left owing, it is said, to a severe outbreak of cholera eight months ago; one or two small huts remain standing and are inhabited; fine jungle all round.

9 miles, 6 furlongs. Manikgura.—A few huts in a small clearing in the jungle; good jungle around.

12 miles, 2 furlongs. Torbor.—A good-sized village, with a large tank, and ample fields and gardens; rich, dark soil; jungle all round.—A camp of Brinjarries was here with 300 bullocks carrying rice; they have come from Raipur and are on their way to Parvatipuram (which they say it will take them a month to reach); thence they go to Nowpada for salt; good camping ground, supplies available.

Drinking water from tank and river, no wells.—A vaccinator (a Mussulman) has lately arrived here from Raipur. He has experienced some difficulty in procuring supplies, as he had orders, so he said, to obtain all he wanted without payment.

Height of Torbor above mean sea level 949 feet; rise from Kāmūna 92 feet.

Distance from Vizagapatam 278 miles, 3 furlongs; from Raipur about 93 miles.

14th December.—Torbor to Sialjōri. Thermometer...
 6 A.M. 52°.
 11 A.M. 82°.
 4 P.M. 80°.

Exposed to the sun at noon, 116°.

Distance 11 miles, 5 furlongs, 175 yards.

1 mile 1 furlong.—Stream, 26 feet $\times$ 6 feet; low banks, sandy bed, no rock. Tree and scrub jungle with a few fields here and there, soil hard and gravelly; then some heavy and dense jungle.

A track 20 to 30 yards wide has been cleared through the densest parts of the jungle, and leads evenly over hard and high ground without much change of gradient.—Another small stream, 12 feet $\times$ 3 feet; low banks, gravelly bed; some rice-fields about.

The railway should be kept on the lower ground to the west; jungle light; soil, dry and hard.

Two small streams close together, each 6 feet $\times$ 3 feet.

4 miles, 183 yards, a stream, 50 feet $\times$ 10 feet; crossed below the junction with a smaller stream; one bank high, the other low; bed sandy; some rock for foundations.—Some sal trees about here; much quartz. Light scrub jungle with a few patches of cultivation.

Small nullah, 6 feet $\times$ 3 feet. 5 miles, 2 furlongs, a large pool in the fields, near a small village, Daidalli.

Some cotton grown here and a good deal of rice; high ground, dark soil. This scrub jungle.

6 miles. Nuaydra, in a large clearing, high ground, dark soil; wet and dry fields. This village of Kandamuri.—The custom of the villagers in these parts is to bring tobacco to approaching strangers (everybody smokes here), sometimes they bring buttermilk besides.

8 miles, 4 furlongs, 113 yards. Sāmbarāngi.—From here leads a track to Tarnot (Khōk).—There are three tombs here on the roadside, where the headmen of the village are buried; the graves are marked by heaps of stones. The common people are buried in the jungles, or else burnt.—Iron is manufactured at Sāmbarāngi.—The place was probably named after the sambar which seem to be plentiful here, to judge from the traces they leave.—Open country, then light jungle. A small stream 10 feet $\times$ 4 feet.

9 miles, 6 furlongs. Kajurbara.—Undulating ground; the line of rail should keep a mile further to the east; soil, dark rich clay.

A fine hill ridge, the Ganda-Mardau hills, 3,000 feet high, 6 to 8 miles long with a plateau on top a mile broad, larger than Rāmandroog, lies 15 to 20 miles to the east.

Two small streams, close together, each 12 feet $\times$ 4 feet; no rock.

There is some game in these jungles and in the low hills to the west. The traces of bear, sambar and bison are frequently seen. A small cheetah was brought in that had been killed in a fight with a larger one near the village, where both were hovering about the cattle.

11 miles, 6 furlongs. Sialjōri.—The line of rail should run about a mile to the east of this.

Height of Sialjōri above mean sea level 1,047 feet; rise from Torbor 98 feet.

Distance from Vizagapatam 290 miles; from Raipur about 82 miles.

15th December Sialjōri to Birumāl, on the line to Onki. Thermometer...
 6 A.M. 50°.
 11 A.M. 78°.
 4 P.M. 80°.

Exposed to the sun at 4 P.M., 86°.

Distance 10 miles 7 furlongs.

In the first mile a small nullah 8 feet $\times$ 3 feet; some thin jungle, then open country, eastwards since the map was made. Villages here sometimes shift their site.—Some Brinjarries belonging to these parts were buying gingelly seed in order to take it to Parvatipuram via Junāgar and the Mūsa ghāt.—High ground, hard soil; jungle.

The railway should be 1½ miles to the east of the straight line from Sialjōri to Jalbal; the ground to the east is not so high, and more even; but the jungle is very dense. Many traces of

sambar and some of bison; soil hard; a long stretch of trackless jungle; near Jalbal it becomes lighter. Stream 10 feet $\times$ 5 feet, no rock visible.

Emerging from the jungle we come upon the village of Jalbal, 5 miles 2 furlongs. Here the rail to Raipur will turn north-westwards to Nara; but we now continue our northerly march towards Onki to explore the ground in case the rail should be taken there. Open ground round Jalbal, some wet and dry fields; in the gardens are chillies, beans, pumpkins, hybiscus, castor oil and tobacco. South of the village the soil is chiefly light, to the north mostly heavy and black. The higher ground is generally of light soil, the lower parts are swampy; but the undulation of the ground is very slight.

A small tank, breached; a stream 9 feet $\times$ 3 feet used for irrigation comes through the breach, muddy bed and banks.

Gūchhapali, the site of a deserted village; the inhabitants are said to have left 20 years ago on account of cholera; there is no trace of the village left, except the fields, which are still partly cultivated.

Kōdumēra, a mile to the left; light soil, open country, good camping ground.

Small nullah, 12 feet $\times$ 5 feet.

Daripali, small village; some iron furnaces here; the ore worked is of two kinds, hæmatite, and bog ore.—Here is also a weaver's loom.—Country somewhat open. Sál trees are found in the surrounding jungle. Light soil, brown clay with sand.—Then dense jungle of shrubs and small trees. Level ground.

10 miles, 7 furlongs. Birumāl in a jungle clearing, a mile in diameter; soil hard; good camping ground, except that the only drinking water available, viz., from the tank or dammed up stream, is inferior; but wells could easily be dug in the fields, the water being not far below the surface. There are no wells in these villages.—The line of rail should be half a mile to the east of this, where the ground is more even.

Height of Birumāl above mean sea level 1,013 feet; fall from Sialjōri 34 feet.

Distance of Birumāl from Vizagapatam 301 miles.

16th December.—Birumāl to Amūndi. Thermometer...
 6 A.M. 47°.
 11 A.M. 80°.
 4 P.M. 77°.

Exposed to the sun at 3 P.M. 102°.

Distance from Birumāl to Amūndi 12 miles 2 furlongs.

Height of Amūndi above mean sea level 918 feet; fall from Birumāl 95 feet.

Distance from Vizagapatam 313 miles 3 furlongs.

In the first mile a nullah, 15 feet $\times$ 5 feet, dammed up in several places so as to make it spread over the adjoining fields on both banks which are cultivated with rice; hence the ground on both sides is very swampy and difficult to get across, even at this season when the rice crops have been harvested; then jungle.

Pāra, a Brinjarri village which has been here for the last three years only; the people of Gyran would not allow the Brinjarries to live in their village from fear that cholera might be introduced by that wandering tribe, so the Brinjarries had to build a village of their own.

1 mile, 4 furlongs, 192 yards. Gyran. A largish village in the midst of an extensive jungle clearing; further on the jungle is light; soil, dark, stiff clay.

2 miles, 4 furlongs. Sēdebatta. A new village, only six years old, not marked on the map; rich, dark soil; there are some weavers here; then jungle again, not very dense; ground gently undulating. Large clearings alternating with stretches of jungle; soil, lighter on rising ground, and heavier in the hollows which are mostly swampy.

3 miles, 4 furlongs. Bavanākēla.—Black soil; extensive rice-fields. Small nullah 10 feet $\times$ 4 feet, converted into wet fields; then some undulating ground with light jungle.

Stream 20 feet $\times$ 5 feet used for irrigation, muddy bed and banks.

5 miles, 6 furlongs. Village of Bisara.—Another stream dammed up in several places in the manner in vogue here, and converted into swamps for rice cultivation. Then jungle of trees and scrub, on light sandy soil; the jungle soon becomes dense and contains numerous sál trees; after a mile of this the bush becomes thinner again. The soil continues chiefly light (with black patches here and there) and the ground slightly undulating till past the 8th mile. At the beginning of the 9th mile a small muddy stream, 10 feet $\times$ 4 feet, used for irrigation.

9 miles, 210 yards. Village of Beltikri. Open country around, the jungle clearing measuring about a mile in diameter. A mile beyond Beltikri, a nullah 20 feet $\times$ 8 feet, with swampy bed and steep banks.

11th mile, Balésar, an ordinary small village with gardens and fields; then sál jungle.

12 miles, 3 furlongs. Amūndi, surrounded by jungle containing numerous sál trees which abound in this part.

Country open; good camping ground; drinking water from the Jong river. Supplies available; soil, dark clay; quartz and kunkur limestone found along the whole route; gneiss continues to be the prevailing rock formation.

Iron ore (hæmatite) is smelted at Amūndi. The villagers have a number of crude carts with solid wooden wheels, drawn by black buffaloes; cattle numerous.

The greater part of the country traversed from Karial up to this (mostly jungle, and much of it virgin soil) would, I believe, produce good wheat crops with very little cultivation.

No difficulties exist with regard to the railway, the country being practically flat, well watered and wooded, though sparsely peopled.

17th December, Amúndi to Onki and back to Amúndi. Thermometer { 6 A.M. 43°
12-30 P.M. 80°
4 P.M. 78°.

Distance 6 miles, 7 furlongs.

Height of Onki above mean sea level 899 feet. Fall from Amúndi 19 feet. Explored both banks of the Jong river; crossed over to Cheruda on the left bank, thence went to Nilasar. (The "Cheruda" marked on the map on the right bank, a mile north of Amúndi, does not exist, and the people say there never was such a place on the right bank.) Fine jungle; soil black, full of cracks, fissures and holes; then scrub jungle and high grass. Some people have come here all the way from Rájim to cut grass and take it away for thatching, &c. The grass is very long and strong, and is used for making mats, fences, verandah screens, and for thatching roofs.

Nilasar is a small collection of mud hovels in the midst of sal jungle; thence I went to Belanger on the right side of the river; jungle of scrub and grass; soil, dark and rich; a kind of hemp is grown here, called "son" in Hindi and janam nara in Telugu.

The nullah near Belanger is 50 feet wide and 15 feet deep; one bank is 15 feet high, the other low and subject to inundation during floods. There is rock for foundations.—A stretch of coarse grass jungle, the grass 10 feet high, and upwards; then some sal jungle, and irregular ground. A small nullah 6 feet x 3 feet; light soil, hard and stony.

Two small streams each 15 feet x 5 feet, beds and banks muddy; then good tree jungle with ippa, sal and malti; ground flat again, soil light.

Marched over some very holy ground; black soil with wide and deep cracks and fissures, and deep holes where the ground has subsided from the rain. These holes occur every few yards and, covered with grass as they are, it is difficult to avoid putting one's foot into a hole. It is impossible to ride over this ground.

6 miles, 7 furlongs, Onki.—A small collection of miserable hovels in a howling wilderness, jungle all round; soil, stiff dark clay. The people of the village at sight of us ran away, but returned again by-and-by.—Returned to Amúndi on the right bank via Belanger and Parada (the latter two miles north of Amúndi); crossed two small streams, 20 feet x 5 feet each, dammed up and converted into swamps for rice cultivation; and a larger stream 45 feet x 8 feet, a mile north of Amúndi, with high banks, sandy bed, and no rock.

Reached Amúndi at 12-30 P.M., having travelled 14 miles 3 furlongs since 6 A.M., taking observations, making notes, &c.; the temperature during this time having varied between 43° and 90°.

Straw about here is plentiful and cheap; it is left in the rice-fields to rot and manure the ground; only the ears of the paddy, with a short length of straw, being cut off in harvesting.

There is a remarkable scarcity of mosquitos in these jungles. I have only seen one small snake since leaving Párvatipuram, and met no scorpions or centipedes; white-ants are not plentiful. I have seen no hares nor rabbits, no wild pig nor deer, except a tame one in a village; very few jungle fowl, no pea fowl, no bustard; pigeons are numerous; partridge, quail and snipe scarce.

There are ducks, and other water fowl on some of the tanks; also cranes, storks, plovers, and white geese and paddy birds; some Java sparrows, minas, paroquets, a few swallows; crows are scarce in the small villages in the jungles; jackals everywhere plentiful.—Gum, dyes and resin (sát) are to be obtained from several jungle trees.

There is a pretty orchid growing on some young ippa trees, with a red flower like honey-suckle.

Distances of Onki from Vizagapatam 320 miles 2 furlongs.
Do. from Raipur about 70 miles.
Do. from Sumbulpoor about 100 miles.

18th December, returned from Amúndi to Birumál, distance 12½ miles. Thermometer { 6 A.M. 43°
11 A.M. 74°
4 P.M. 78°.

The sick whom I had left behind in the camp at Birumál had improved during their two days' halt there.

19th December, returned from Birumál to Jalbal, thence to Nara.

Distance travelled 14 miles, 6 furlongs, viz., Birumál to Jalbal 5 miles 6 furlongs.
Jalbal to Nara 9 miles. Thermometer { 10 A.M. 40°
11-30 A.M. 91°
4 P.M. 80°.

There was some frost on the ground in the morning, between Birumál and Jalbal. Resumed march to Nara, where we left off on the 15th. After leaving Jalbal, some light jungle was passed through, on light clayey soil.

1 mile, 2 furlongs, 94 yards.—Village of Salia; country rather open, very little jungle about. Wet and dry fields, and garden cultivation; some laterite was seen cropping out.

2 miles, 1 furlong, 108 yards. Chanabada.—A tank, gardens and fields. Plantains in the gardens, the first seen since Bisewikattak. Country open, trees and shrubs about.

2 miles, 6 furlongs, 71 yards. Stream 35 feet x 10 feet, sandy bed, banks low and flooded. Then a swamp at this season dry, except in the lowest part.

3 miles, 2 furlongs, another swamp,—with a stream running through it about 30 feet x 8 feet; the bed is muddy and irregular and has several branches; swamp extends close up to Amseri.

3 miles, 4 furlongs, 149 yards, the village of Amseri on high ground, with a tank and wet and dry fields. Near the village is a small hillock through which a quartz reef runs. Then light jungle with some swampy patches. Then high ground with light jungle on hard soil, followed by a gentle descent, with another stretch of swamp partly cultivated.

5 miles, 4 furlongs, 109 yards. Kopathora.—Gardens and fields; tame pigeons are kept in many of these villages, and on the trees are found large blue, green and grey pigeons in a wild state.

No bustard seen, very few partridges, scarcely any snipe.

6 miles, 6 furlongs. Mograpali.—With a tank and the usual cultivation. Met a large herd of Brinjarri bullocks carrying wheat to Párvatipuram.

Village of Kurumura, small, not marked on the map.

8 miles, 2 furlongs, the Jong stream, 600 feet wide, depth in flood 16 feet; irregular, sandy bed with small islands, low banks subject to floods, no rock visible. This river is the boundary of the Karial estate.

9th mile. Nara.—Large village, the head-quarters of a Zemindar who owns twelve villages. The old Zemindar is 84 years of age and infirm, his sons and his Dewan came to the camp and attended to our wants; guides, coolies and supplies were promptly furnished. There is a good encamping ground at Nara, good water to be had from tanks and the river, there are also some wells in the gardens.

In the village are weavers and iron smelters, no carpenters.

The Police Officers of the Karial Rajah, who had accompanied the camp up to this and been very useful, returned from here.

Height of Nara above mean sea level 1,010 feet; fall from Birumál 3 feet, from Sialjóri 37 feet.

Distance of Nara from Vizagapatam 304 miles 3 furlongs; from Raipur about 62 miles.

20th December.—Nara to Bagbahra.—Distance 10 miles, { 6 A.M. 41½°
11 A.M. 80°
4 P.M. 80°.

5 furlongs. Thermometer. Passed through some paddy fields and uncultivated swamps, crossed two small streamlets requiring culverts, then a fine tank near the village of Bendraan, 1 mile 4 furlongs. No jungle here, all cultivation, both wet and dry.

2 miles, 4 furlongs. Village of Ukra; much wet cultivation. Then thin scrub jungle.

A small village, named Lámi; jungle again, with a few isolated patches of fields.

4 miles, 1 furlong, 153 yards. Kandajori stream 250 feet wide, 16 feet deep, sandy bed with some rock; banks low, and flooded in the rains. The rock is gneiss, with quartz and feldspar in veins and patches.

The railway need not cross this nullah if the Jong river is bridged a mile below Nara.

4 miles, 5 furlongs, 155 yards. Kumakan.—A large village; the Zemindar of Súarmal lives here, who owns 80 villages. This village has two tanks and a large sawny place in a shed; a new building is being constructed of stone; beyond the village, a nullah 20 feet x 4 feet.

5 miles, 7 furlongs, 94 yards. Kálin.—With extensive fields; black soil; then some high ground with thin jungle on light soil. A tank; jungle again; small nullah 6 feet x 3 feet.

8 miles, 2 furlongs. Páluari.—A few huts in a small jungle clearing; soil, dark clay with sand.

8 miles, 7 furlongs, 133 yards. Kopli.—A large village where a new tank is being constructed by the Zemindar of Súarmal, Umra Sing, who met me outside the village with his two little sons and a large following, and accompanied me to Bagbahra. He was most attentive to the wants of the party and asked that the Government might be informed of this fact. He seemed very energetic and intelligent, and was pleased with the prospect of a railway through these parts.

A letter from the Commissioner of Raipur, dated the 9th November and addressed to me at Bondesor, was brought to me only to-day by a Policeman from Bondesor who had walked 120 miles in four days.

Height of Bagbahra above mean sea level 1,083 feet; rise from Nara 73 feet.

Distance of Bagbahra from Vizagapatam 315 miles; from Raipur about 55 miles.

21st December.—Bagbahra to Telibanda. Distance 12 { 6 A.M. 52°
11 A.M. 87°
4 P.M. 89°.

miles, 6 furlongs, 204 yards. Thermometer.

Some rice fields in the lower grounds; then jungle; a small streamlet with rocky bed; irregular ground, slightly hilly; jungle of brushwood and trees for nearly 4 miles on varying soil, mostly rich dark clay. In the jungle (3rd mile) Pendri, the site of a deserted village which the people are said to have left on account of want of good water; dense jungle. At the end of the 3rd mile a nullah 25 feet x 5 feet, sandy bed, low banks, no rock. Further on, two small nullahs 10 feet x 4 feet each; a third 8 feet x 3 feet; undulating ground.

5 miles, 5 furlongs, 79 yards.—Patrapali, with fine garden cultivation, and wells; maize, hemp, onions, garlic, spinach, beans, pumpkins, chillies, brinjals, plantains, castor-oil, mustard, sugarcane, tobacco, &c., are grown here. Met 200 Brinjarries' bullocks carrying gingelly seed and wheat to Párvatipuram.

6 miles, 5 furlongs, yards 203. A shallow nullah 100 feet $\times$ 6 feet, low banks, sandy bed; all jungle again. Another nullah close to the former, 50 feet $\times$ 4 feet, with low banks and sandy bed. Some paddy swamps; then the village of Kasibara at 7 miles, 5 furlongs, wet and dry fields, and gardens with wells; jungle again; a small nullah 8 feet $\times$ 3 feet.

9 miles, 3 furlongs. A stream 60 feet $\times$ 5 feet with sandy bed and low banks, near the site of Aorababri, a deserted village. Black soil, full of cracks, fissures and holes; scrub jungle with swamps, uncultivated. Two small swampy streamlets 5 feet $\times$ 2 feet. More swampy ground; then another. Kasibara, a large village at the end of the 12th mile; gardens with wells and extensive fields. The water in the wells is 6 to 10 feet below the surface; laterite is found here. A Superintendent of Vaccination from Raipur, and a Vaccinator were in the village.

12 miles, 6 furlongs, 204 yards. Telibanda, small village. A Head Constable from Korti, which has a Police station and Post office, came here to assist the camp. A Munshi, sent on the 12th November by the Deputy Commissioner of Raipur to meet the party at Kariel, turned up here only to-day (having been to Kariel and missed me) and made himself useful in procuring supplies, &c.

Height of Telibanda above mean sea level 1,022 feet; fall from Bagbahra 61 feet. Distance of Telibanda from Vizagapatam 327 miles, 7 furlongs, 117 yards; from Raipur about 46 miles.

December 22nd.—Telibanda to Mahasamund.—Distance 11 miles, 6 furlongs, 124 yards. Thermometer, 6 A.M., 47°; 11 A.M., 80°; 4 P.M., 80°.

Passed over extensive rice fields, now nearly dry, the crop having been gathered. Then jungle on slightly undulating ground.

2 miles, 6 furlongs. Mamubancha, a large village with much cultivation around. Then an uncultivated swamp, with a small stream, 10 feet by 4 feet, running through the deepest part; muddy bed and banks.

3 miles, 7 furlongs.—The site of Pathripali village, now deserted; no sign of former cultivation; jungle all round. The people are said to have been engaged in illicit dealings with timber and spirits, hence they were driven from the village. All jungle. Some laterite is seen cropping out.

4 miles, 170 yards. Sikhi nullah, 25 feet by 8 feet; sandy bed, good banks, no rock. Then some clearing with cultivation. Soil black, full of holes. Small nullah, 6 feet by 3 feet.

5 miles, 190 yards. Arang, a considerable village, with fields and gardens. Wells in the latter; water about 10 feet below the surface, and said to be good.

6 miles, 3 furlongs. Umarla, a small village with a tank.

7 miles, 1 furlong.—A stream 15 feet by 6 feet, with laterite rock for foundations. Light clayey soil; jungle.

7 miles, 6 furlongs, 120 yards.—Stream 10 feet by 4 feet; laterite gravel in the bed. Jungle on both sides. Then a swamp; beyond that two small villages, Murmar and Kamari. Then two small nullahs, 9 feet by 3 feet.

There is much laterite about here; the prevailing rock formation is still gneissic, which ceases at the Mahanadi.

9 miles, 1 furlong.—The village of Pathripali, where a blacksmith is at work with rude implements and contrivances.

A small stream, 4 feet by 3 feet, then a larger one 12 feet by 4 feet.

10 miles, 3 furlongs, 182 yards.—Pitajer, small village.

11 miles, 6 furlongs, 124 yards. Mahasamund, a large place, said to contain 400 houses and over 1,000 inhabitants. Carpenters and blacksmiths here. A survey station and a temple are prominent objects. The soil consists chiefly of laterite; water is good. Encamping ground high and extensive. A tank; topes and trees about. Here is the beginning of a cart-road marked out by side drains, leading to Arang; and here also the track from Tarnot (via Tendubara, the Sirgidi Ghat, Kamaria and Korti) joins our line.

Height of Mahasamund above mean sea level, 915 feet; fall from Telibanda 107 feet.

Distance of Mahasamund from Vizagapatam 339 miles, 6 furlongs; from Raipur 34 miles.

December 23rd. Mahasamund to Arang.—Distance 10 miles, 2 furlongs. Thermometer, 6 A.M., 44°; 11 A.M., 79°; 4 P.M., 75°.

Marched along a cart track, partly lined out and roughly made. All fields, no jungle.

1 mile, 3 furlongs. Kharora, a large village with much wet cultivation; good topes; a tank.

3 miles, 5 furlongs. Belsora, a large village like the former. Country level and open, well cultivated; no jungle.

At the sixth mile, near the bank of the Mahanadi, the village of Gorari. Here is some solid kunkur rock; also stratified limestone rock, similar to that at Cuddapah and Kurnool.

Then cross the Mahanadi River. 2,040 feet wide and 25 feet deep during great floods which spread close up to the village of Gorari, covering the ordinary banks near the river's edge to a depth of 10 feet.

The ordinary floods, contained between the banks, and not overflowing them, run about 15 feet deep.

The bridge will require to be 30 feet to 35 feet above the deep bed. The low water at present is 260 feet wide and little more than 2 feet in depth. The bed is sandy; on the eastern bank and in the bed is limestone rock; on the west bank none is visible, but it will probably be found not far below the bed.

A quarter of a mile from the west bank is an irrigation canal taken off from the river. 7 miles, 6 furlongs. Paragdon, with a suburb occupied by potters. Soil, clay and laterite; mostly cultivated; little waste land; no jungle.

Here we join the main road from Raipur to Sumbulpur; a new road is being made to Gorari.

Ninth mile, a nullah, 20 feet by 6 feet; high banks, stony bed (limestone).

10 miles, 2 furlongs. Arang.—Good encamping ground. Fine tope, good water from wells and tanks. Post office, Police station and school here; also a travellers' bungalow, a dispensary, and a fine temple.

Distance of Arang from Vizagapatam 350 miles; from Raipur 23 miles.

Height of Arang above mean sea level 942 feet; rise from Mahasamund 27 feet.

December 29th. Arang to Hasaud.—Distance 13 miles, 4 furlongs. Thermometer 6 A.M., 55°; 11 A.M., 75°; 4 P.M., 78°.

First mile, village of Bihiar.—Open, flat country, well cultivated; black soil.

2 miles, 6 furlongs. Kismi, an ordinary village, with tope and tanks; sugarcane and rice-fields.

5 miles, 2 furlongs. Tappal hut.—The ground here is gently undulating; soil laterite; the whole of the country so far as the eye can reach is cultivated; little waste land; no jungle; firewood is scarce; no hills.

Trees are few and far between, but each village has one or more topes and tanks; some have wells.

7 miles, 2 furlongs. Kulhan stream, 50 feet wide and 10 feet deep in flood; high perpendicular banks; bed gravelly, no rock visible.

10 miles, 2 furlongs. Nakogon, a small village with a Police station, temple, tope and tank; soil in some parts red, in others black; ample fields, dry and wet. Here I met the first wheat fields along this route; there were none east of this.

13 miles, 4 furlongs. Hasaud, a large village, with tanks, topes, wells and extensive cultivation. Soil, light brown clay. Good encamping ground.

Distance of Hasaud from Vizagapatam 363 miles, 4 furlongs; from Raipur (east end) 84 miles.

Height of Hasaud above mean sea level 969 feet; rise from Arang 27 feet.

December 30th. Hasaud to Raipur.—The country is flat and well cultivated, with both wet and dry crops.

2 miles, 1 furlong. Sirikheri, village with tope and tank.

3 miles, 5 furlongs, 185 yards. Jora, similar to the last, with much wet cultivation; black soil.

5 miles. Labhandih, similar to the last two villages; black soil. A stream 40 feet by 8 feet, with high banks, and limestone rock in the bed.

Half a mile further a smaller stream, 15 feet by 6 feet; banks and bed of black soil.

Much wheat and linseed are grown about here.

6 miles, 6 furlongs, 130 yards. Village of Telibanda or Kurwatoli; with a fine tank, and tope of Mhowa trees.

8 miles, 1 furlong, 80 yards. East end of Raipur Cantonment, near the Deputy Commissioner's Court.

The distance of Raipur from Vizagapatam by the route marched over is 371 miles, 5 furlongs, 211 yards.

Altitude of Raipur above mean sea level 962 feet.—I went at once to see the Chief Commissioner of the Central Provinces, Mr. Morris, B.C.S., who was here on tour; and the Commissioner of the Chattisgarh Division, Colonel Lucie-Smith; both officers are going into camp to-morrow, en route to Belaspur.

RAIPUR,
6th January 1882.

(Signed) K. F. NORDMANN,
Executive Engineer, on Special Duty.

XII.

From K. F. NORDMANN, Esq., Executive Engineer, on Special Duty, to the Secretary to Government, Public Works Department, dated Raipur, 14th January 1882, No. 27 R.

IN continuation of my letter No. 24 R., dated 6th instant, I have the honor to inform you that I have this day posted to your address a tin case, containing the longitudinal section of the country traversed by the reconnoitring party, from Parvatipuram to Raipur, and the cross sections of all streams exceeding 30 feet in width.

2. I have despatched one camp this day, and leave Raipur to-morrow for Rajim, whence I march up the valley of the Pairi, and then up the Sondor river, passing Noagarh, then up to Raigarh, Omorkot, Narangpur and Kuraputi.

3. Mr. Cormac follows via Dhamtari, Kankér and Banskót to Omorkót, where we expect to meet about the 1st of February; reaching Kuraputi about the 14th idem.

4. From all the information I have been able to collect, I see no necessity for examining a line leading from Dhamtari up the valley of the Silári to Sihóá and Borái, which was travelled over and reported on, in 1876, by Colonel Francis, then Executive Engineer at Raipur. This line goes over some very high, rough and uneven ground, and seems in every respect inferior, for the purpose of a railway, to either the line up the Sondor river, passing near Noagarh, or the line via Dhamtari, Kankér and Banskót.

5. I beg that letters may be addressed to "*Narangpur via Kuraputi, to await arrival.*"

XIII.

From K. F. NORDMANN, Esq., Executive Engineer, on Special Duty, to the Secretary to Government, Public Works Department, dated Kuraputi, 25th February 1882, No. 38 K.

In continuation of my letter, No. 27 B, dated Raipur, the 14th ultimo, I have the honor to submit herewith my Notes of Reconnaissance of the country between Raipur and Kuraputi via Rajim, Kópra, Bourka, Noagarh, up the Pairi and Sondor Rivers, then via Háthgaon, Raigarh, Omorkót and Nárangpur to Kuraputi, a total distance, by the straightest and easiest route, of 217½ miles.

A. Executive Engineer's Notes of Reconnaissance from Raipur via Rajim up the Sondor River to Nárangpur.

B. Do. do. from Nárangpur to Kuraputi via the Mádeoputi Ghát.

C. Mr. Cormac's Diary from Raipur via Dhamtari and Kankér to Omorkót.

D. Do. do. from Pupogáon to Kuraputi via Jeypur.

E. Do. do. Report No. I-O, dated 1st February 1882.

F. Reports by Colonel Francis on routes from Raipur via Dhamtari and Sihóá towards Raigarh.

Rajim I marched up the right bank of the Pairi River. The ground traversed is on the whole very favorable for the construction of a railway. The country is fully cultivated as far as Kópra and some miles beyond, and the gradients are generally light.

3. Near Bourka there will be some hill-side cutting required, for upwards of a mile along the steep and stony banks of the Pairi River. This part of the work, although insignificant in itself, may be reckoned among the heaviest that will have to be done on this line, which is a remarkable easy one throughout.

4. Near Karti I crossed the Pairi River, here 1,530 feet wide and 18 feet deep, and then passed over some high ground, culminating at the head of the Urtáli Ghát to Noagarh. The Urtáli Ghát is a steep ascent of about 120 feet, over which the present track passes, but which would be circumvented by a regular road or a railway line. Thence I marched up the right bank of the Sondor River via Baltema and Tumaribahal to Karkó, and, crossing the Bag River, to Risgaon, Gourgaon, and Háthgaon.

5. There is no need for taking the road over the Urtáli Ghát to Noagarh, which is a very small place, although the head-quarters of a Zemindar; as the line can be taken entirely up the right bank of the Sondor River from Karti via Benkura and Karká to Baltema. At Risgaon I fell in with the Brinjarri traffic from Jeypur and Kuraputi; the trade route leading from Raigarh via Háthgaon, Gourgaon and Risgaon to Sihóá, and thence to Dhamtari.

6. The sections, which will be submitted in a few days, show that the ascent up to Háthgaon (1,870 feet above mean sea level) is a very gradual one. From Háthgaon begins the final ascent on to the Jeypur plateau. There is a total height

of 220 feet to be overcome, which, distributed over 5 miles, gives a gradual rise of 44 feet per mile, or 1 in 120. This route is quite practicable for a railway throughout, no regular ghát or steeper gradient than 1 in 100 being required; while the line passes through many miles of magnificent forest on virgin soil in a country full of promise, containing all the elements of future prosperity, where hundreds of square miles of the most fertile ground are waiting for the plough.

7. The Golárah nullah, a mile to the east of Háthgaon, offers the greatest facility for taking a road up to the Jeypur plateau by a light gradient. The work will be quite easy; the jungle is dense, but there is only a small amount of hill-side cutting or ghát work required, very little heavy embanking and bridging, and as little rock blasting.

8. The whole country passed through from Bourka to Háthgaon is covered with forest and jungle. Villages are few and far between, especially in the upper course of the Sondor River; but the soil being good and well drained, the agricultural capabilities of the country are unlimited, and only wait for development.

9. The highest elevation reached on the Jeypur plateau, near its edge, was 2,100 feet above mean sea level, at Koliapodor; the distance traversed from Raipur to Omorkót 143 miles.

10. At Omorkót I met Mr. Cormac on the 31st January, who had marched from Raipur through the rich grain country of Dhamtari via Dargahan to Kankér, then up the valley of the Hatkul River to Banskót in Bustar, thence via Paorbel, Gurjunga and Bakúda to Omorkót, total distance 150½ miles. This line is 13 miles longer than the route I traversed, i.e., via Rajim and up the Pairi and Sondor Rivers; but the former also proved easy, as shown by Mr. Cormac's report (hereto appended) and his sections (which will follow), except in that part of the Hatkul valley between Chiprail and Siduwan, where for 4 miles a regular ghát road will have to be constructed along the hill-side at an average gradient of 1 in 40. The highest level reached by Mr. Cormac near the edge of the plateau was 2,146 feet near Siduwan.

11. Having carefully compared the two lines above described, I am of opinion that for the railway the shorter line up the Sondor River should be chosen, while the route marched over by Mr. Cormac should be laid out as a road, i.e., from Dhamtari via Kankér to Raigarh; and other feeders should be constructed to connect Dhamtari, Kankér, and Sihóá with the line of rail.

12. From Raigarh via Omorkót and Nárangpur to Ránigar, at the foot of the Mádeoputi Ghát, a distance of 90 miles, the line leads through a rich and beautiful upland country with fertile soil, and fine forest and jungle, at an average elevation of 1,900 feet; the surface in most parts level, in others diversified by hillock and swamp; much of the latter cultivated with rice, the whole offering no obstacles but every facility for the construction of a line of rail.

13. Whether this line west of the Noagarh Hills or the eastern line via Ryaguddah and Ombadóla is chosen for the railway, I would recommend a specially important feeder that should be made in either case, viz., a road between Nárangpur and Ryaguddah, leading from the former place up the Indrávati River to Jagannathpur and Kurmeli, then up the valley of the Golagad River to Maribata and down the valley of the Ryaguddah River to Ryaguddah, a distance of 65 miles. This is an easy and natural line of ghát, and the summit level near Maribata is not more than 2,700 feet above the sea.

14. And whichever of the two lines is selected for the railway, whether that east or west of the Noagarh Hills, I consider that the other line should be made into a good cart road with bridges, &c., complete, to be passable at all seasons.

15. The following lines would seem to be foremost among those required to be constructed as railway feeders, in case the line of rail is taken from Raipur via Rajim, Kópra, Karti, Baltema and Háthgaon to Raigarh, Omorkót, &c.:—

- (1.) Raipur via Dhamtari and Dargahan to Kankér.
- (2.) Kankér via Salabat, Siduwan, and Banskót to Raigarh.
- (3.) Kankér to Jagdalpur in Bustar.
- (4.) Kankér via Sihóá and Sankra to the nearest Railway Station, say Tumaribahal.

- (5.) Sihóá viá Borai to Banskot (on the Kankér-Raigarh line).
 - (6.) Sihóá to Dhamtari.
 - (7.) Dhamtari viá Achota to Kopra or Panduka (to be continued to Chura and Nara).
 - (8.) Noagarh to the nearest Railway Station.
 - (9.) Jeypur to Malkangiri.
 - (10.) Jeypur to Jagdalpur.
 - (11.) Jagdalpur, Kotpad, Nárangpur.
 - (12.) From Omorkót westwards viá Amrati and Bamini to the Baordhig River.
 - (13.) Nárangpur viá Jagannathpur, Kurmeli, and Maribata to Ryaguddah (vide paragraph 13 above).
16. In case the railway is constructed east of the Noagarh Hills, i.e., viá Párvatipuram, Ombadola, Bógor, Kariál, Nara, &c., the lines of road chiefly required to be constructed as feeders would appear to be the following:—
- (1.) Torbor, Tarnot, Tendubara, Kamaria, Karti, Mahásamund.
 - (2.) Sankra (on the road from Raipur to Sumbulpoor) viá Onki to Nara.
 - (3.) Nara, Chura, Panduka, Dhamtari.
 - (4.) Kariál to the teak forest on the Udet River.
 - (5.) Patna to Torbor.
 - (6.) Patna to Bógor.
 - (7.) Asurgor to Sónpoor on the Mahánadi viá Turla and Bamini.
 - (8.) Ryaguddah viá Singapore and the Músa Ghát to Bondesor, Dádpur and Bógor.
 - (9.) Bondesor viá Nandol, Daspur, and Manjher to Kariál.
 - (10.) Daspur to Déobhog, and up the valley of the Tál River.
 - (11.) Singapore to Ombadola viá Lonjigar.
 - (12.) Báliguda viá Tumriband to Ombadola.
 - (13.) Párvatipuram to Kurupám, Butelly, and Goonipur.
 - (14.) Godairy to Bisemkattak.
 - (15.) Ryaguddah to Nárangpur viá Loddah, Maribata, Kurmeli, and Jagannathpur (vide paragraph 13 above).

17. When the Madras Government in 1875 proposed to make a road from the head of the Pottinghy Ghát through the Jeypur country viá Nárangpur, Omorkót and Raigarh to the Central Provinces, the then Executive Engineer, Colonel Francis, at Raipur placed himself in communication with me at Pottinghy, and, under orders from the Nagpur Government, that officer explored the country within his charge with a view to finding the best line of road to connect Raipur with our proposed road through the Jeypur country. I have obtained through the Executive Engineer at Raipur a copy of Colonel Francis' report, which I beg to append to these papers. From this report it will be seen that the several routes explored by Colonel Francis are unsuitable, on account of the hilly nature of the country, for the purposes of a railway; but one of the routes, viz., that from Raipur viá Dhamtari, Kukrel, Dokal, Gatáali, Burgudi, and Borai will do very well for an ordinary road to act as a feeder to the railway.

18. From Pupogaon, 17 miles south of Nárangpur, I sent Mr. Cormac to Jeypur, and thence up to Kuraputi by the new road, to report on the lay of the

* Report and section appended.

country and take a section* of the ghát leading up to Kuraputi; while I marched viá Cheptaamb and Ránigar up the old Mádeputi Ghát, in which direction, i.e., up the Kuradi nullah, the easiest line for a railway to the Kuraputi plateau is to be found; the gradients on this line will not exceed 1 in 75. The railway station for Kuraputi would in this case be near a village called Dengagura, about $2\frac{1}{2}$ miles east by north of Kuraputi, and 100 feet lower than the latter place. Kuraputi itself, being near the edge of the higher plateau, is not easily accessible for a railway from below, except by means of steep gradients. From Dengagura the line would gradually ascend to Durniput, and thence go on viá Chikapár towards Sálúr. This section of the road will form the subject of a separate report when the reconnaissance of that part of the country and of the ghát portion of the line has been completed. I leave Kuraputi in a few days to undertake this the last section of the reconnaissance.

19. As regards the general question of the location of the proposed line of railway, i.e., whether it should go east or west of the Noagarh Hills, it seems too early to discuss the subject until the most difficult part of line now being explored, viz., the ghát leading from the 3,000 feet plateau to Sálúr, has been carefully considered by the light of figures and otherwise. But I may, perhaps, even at this stage of the investigation, be permitted to make a few observations bearing on the question, and I therefore submit the following points for consideration:—

- (1.) The economical importance of the country to be developed is probably equal on both sides of the Noagarh Hills, except perhaps that, looking to the rich and fertile, rice and wheat producing country of Dhamtari, the balance would appear to incline in favor of the western line which taps that great grain country.
- (2.) The development, likewise, of the natural resources of the Jeypur State in the direction of the western route, may be considered a pressing necessity, and the railway on this line would lead all through Madras territory to within 100 miles of Raipur. Of the present grain and salt traffic, between Chattisgarh and the coast, the major portion passes undoubtedly along the western route, as cannot fail to be observed by any one who travels over both routes.
- (3.) For military and political reasons the western line also may be thought the more important of the two, bearing in mind the desirability of bringing the railway near Jeypur and Bustar, where there have been from time to time outbreaks of rebellion which may occur again in future.
- (4.) The engineering difficulties of both lines are much the same, but the cost of the western line would be somewhat enhanced on account of the gháts which have to be surmounted at an altitude of over 3,000 feet, while on the eastern line the greatest elevation reached is only 1,346 feet. The item of bridging would probably be more costly on the eastern than on the western line, the former crossing a greater number of formidable streams than the latter.
- (5.) As regards length, the western line will be from 20 to 30 miles shorter than the eastern, the saving in distance varying between the two figures named according to the gradient that may be accepted for the ghát portion of this route. With a gradient of 1 in 57 the saving in distance would amount to about 24 miles. But the shorter line would not be on that account much less expensive than the longer one, since the 25 or 30 miles of ghát work would cause extra outlay on the shorter line and so nearly assimilate its cost to that of the longer one. The relative cost of the two lines would roughly stand about thus:—

Cost of eastern line, 372 miles, at £5,000 per mile	£ 1,860,000
Cost of western line { 320 miles, at £5,000 per mile	1,600,000
{ 30 " at £8,000 do.	240,000
	1,840,000

- (6.) Finally, if Vizagapatam is to be improved as a port, it will be very advantageous in many respects to be able to send indigenous coal to the port, and for this purpose a railway from the Godáviri coal-fields to Vizagapatam would eventually have to be constructed. Now, if the Raipur railway at present under discussion is taken west of the Noagarh Hills, it will answer for a certain distance the purposes of the coal traffic from Chanda to Vizagapatam, as well as the grain traffic from Raipur to Vizagapatam. In fact, part of the line from the port of Vizagapatam to the coal-fields will virtually be made by taking the Raipur railway west of the Noagarh Hills. This western line will therefore save so much future outlay on a separate railway which would have to be constructed from the port to the coal-fields, and it will

answer the combined purposes of the Chanda-Vizagapatam coal traffic and the Raipur-Dhamtari Vizagapatam grain traffic.

Taking the whole distance from Vizagapatam to Chanda to be 450 miles, then about one-third of this distance, i.e., nearly 150 miles, would actually be made by taking the Raipur railway west of the Noagarh Hills. And, possibly, we may not have to go as far as Chanda or Warora for coal, since there is every likelihood of coal being ere long discovered in the valley of the Kolab river between Jeypur and Bustar, and in the Malkangiri Taluk of Jeypur. This will constitute a strong argument in favor of the railway being brought near these parts.

20. Observations regarding natural resources, produce, labor, soil, climate, seasons, manufactures, trade, population, &c., along the routes explored have been recorded from time to time in my Notes of Reconnaissance, as directed in Paragraph 12 of G.O., No. 2294 W., dated 16th September 1881; the following is a summary of the observations recorded under these heads:—

(1.) BUILDING MATERIALS PROCURABLE; MINERALS AND METALS FOUND.—Materials, such as timber, building stone, clay for bricks, sand, limestone, iron, &c., are equally available on both lines. The rock formation is chiefly gneissic, except west of the Mahanadi, where sandstone and limestone rock prevail. Nodular kunkur limestone and different iron ores abound along both routes, except that kunkur is scarce on the Jeypur plateau. Quartz veins and reefs were found in many places; also some rubies and garnets. Traces of lead, graphite, antimony, arsenic, copper, silver and gold were met in several localities indicated in the notes. The soil is more or less fertile throughout on both lines, and varies from black cotton to light sandy loam. I scarcely saw any very poor soil anywhere.

(2.) CHARACTER AND AMOUNT OF LABOR AVAILABLE.—Local labor will, on the whole, not be found sufficient for the work on the railway, especially in the more sparsely populated parts, where both skilled and unskilled labor must be imported from other parts. The unskilled labor available will, as a rule, be found of a superior description, quite equal to the best in the Madras Presidency.

(3.) RATES OF SKILLED AND UNSKILLED LABOR.—The rates for unskilled labor are at present low along both routes, averaging $1\frac{1}{2}$ to 2 annas per man per diem, paid mostly in grain, not coin; but these rates will in time, with large works going on, and a great demand for labor, very likely increase to 3 or 4 annas per diem.

Skilled labor will have to be brought from a distance to most parts of the work. The indigenous skilled laborers available, such as carpenters, blacksmiths, iron smelters, masons, &c., are of inferior quality, and very scarce besides on both lines. The rates of wages for such (inferior) skilled labor as there is at present are naturally low, say 2 to 4 annas per diem, paid generally in grain. When skilled labor is hereafter brought to the works from other parts, the rates to be paid in coin will be rather in advance of those prevailing in the more settled parts of the southern country.

(4.) CAMPING GROUNDS, DRINKING WATER, &c.—The country may be said to be equally salubrious on both sides of the Noagarh Hills, and good camping grounds are to be found near most of the principal villages; while wholesome drinking water can generally be obtained from the numerous streams and rivulets encountered on both lines. But where the only water available is from swamps or tanks, as is the case in many places, it is of course of inferior quality, and, especially when beginning to dry up, undoubtedly dangerous if used for drinking purposes. Wells, however, could easily be dug along both routes, the water being almost everywhere found close to the surface.

The forests contain a fair number of wild animals and game, such as tigers, cheetas, bear, bison, buffalo, nilgai, pig, sambhur and deer. There are no elephants. Pea fowl, jungle fowl, partridge, &c., are met.

(5.) CLIMATE AND WORKING SEASONS.—The climate along the several routes naturally varies in some measure; the lines explored between Vizagapatam and Raipur passing through $3\frac{1}{2}$ degrees of latitude, while the elevation varies from sea level up to 1,345 feet on one line and over 3,000 feet on the other. But, allowing for the change of temperature due to an elevation of 3,000 feet on the upper Jeypur plateau, the climate

may be said to be much the same on both lines; and on the whole it is a very favorable climate for carrying out large works during the greater part of the year.

The working seasons are also nearly alike on the rival lines, both being but lightly affected by the two monsoons; practically there is nothing to prevent work being carried on throughout the year, save for a month or so during the first violent burst of the north-east monsoon and for some time afterwards, when the jungles are very unhealthy, say from the end of October to the beginning of December. The hot weather is rather favorable for ordinary out-door labor here as elsewhere in Southern India. The indigenous labor available will not suffer from fever, dysentery, &c., to the same extent as imported labor would.

(6.) CULTIVATION AND MANUFACTURES; FORESTS.—Detailed notes on the prevailing cultivation, in different parts along the several routes explored, have been given in my reports submitted from time to time. About one-fifteenth of all the country marched through, south and east of the Mahanadi, may be said to be under cultivation; the rest is chiefly jungle and forest, with some pasturage and waste land, but there is not much of the last.

West of the Mahanadi, however, and for some distance eastwards from its right bank, between Gorari and Achota, and in the whole of the Dhamtari Taluk the country is fully cultivated, and there is little or no jungle.

The finest forests on the eastern line were found between Bisemkattak and Asurgor, then along the Sunder or Under River in the Karial estate, and between Kumuna and Telibanda; while there is an extensive teak forest 15 to 20 miles south-west of Karial.

On the western route I marched through some magnificent forests, along the course of the Sorul or Sendor River, from Karti up to Raigarh. There is fine and uninterrupted forest (not merely jungle) from Paraga to Noagarh, a distance of 16 miles, with not a village along the whole line.

From Noagarh to Narangpur, and further south, is beautiful forest all the way, sometimes primeval forest, on rich virgin soil. Now and then the tall forest is relieved by common jungle, or small clearings for cultivation, and divided by occasional belts of swampy ground, partly cultivated, through which the drainage of the country passes. The number of villages is small and the population sparse. Hundreds of square miles of the most fertile soil are waiting for the plough. This description of country continues up to the foot of the Madeoputi Ghat leading to the upper Jeypur plateau (Kuraputi).

The useful timber trees chiefly found in the forests are sal and matti, but there are also blackwood, yegi and some other kinds. Teak is rather scarce in these jungles, except in special localities, such as the teak forest near Karial noted above. Of fruit and other useful trees, jack, fig, gooseberry, tunicia, mango, tamarind, margosa, and a variety of acacias are everywhere found. The mhowa or ippa tree abounds in all the country travelled through, north of Ryaguddah and west of Pottinghy, but its wood is not useful for timber.

The sheep and cattle met with were on the whole not numerous, and of a very ordinary breed. Country ponies are to be had at Raipur, Rajim, and Sonpooor, where cattle fairs are periodically held.

The crops, which are much the same east and west of the Noagarh Hills, consist of several kinds of rice, sugarcane, ragi, two or three kinds of gram, millets, oil-seeds, wheat (this last chiefly west of the Mahanadi), tobacco, chillies, mustard, garden vegetables, &c. The quantity of rice grown along both lines, sometimes by means of primitive and inexpensive methods of irrigation, and sometimes dependent upon a few seasonable showers of rain only, is very large, and shows what could be done in this direction by a more numerous and civilized agricultural population. Irrigation is carried on partly by small river and spring channels, or under rudely-constructed tanks; and partly along the sides of nullahs, when the banks are cut down, the ground levelled and small flat valleys created; as well as in swamps, which are to some extent drained and then converted into rice-fields.

The average price of rice at Raipur and Dhamtari in December and January was one rupee for 60 seers, and of wheat one rupee for 45 seers.

Several kinds of oil, coarse sugar, ghee, and alcoholic liquor distilled from the flower of the ippa or mhowa tree are largely manufactured.

Tassa silk and coarse cotton cloths are made at Risga near Tukla in the Karial estate, also near Dhamtari, and in some other places. The tassa silk-worm feeds upon the leaves of sál and matti trees.

Glass bangles and some rough lacquered ware are manufactured at Nárangpur. Skilled workers in leather and iron, as well as gun-makers, brass-workers, goldsmiths and jewellers, are rare.

(7.) TRADE AND TRADE ROUTES.—The chief products carried from Chattisgarh, Jeypur, and Bustar to the coast are rice, wheat, gingelly-seed, linseed, Bengal-gram, horse-gram, turmeric, ginger, dammer, arrowroot, soapnuts, marknuts, myrabolams or gallnuts, hides, beeswax, honey, horns, hoofs, iron, and lac (the product of an insect). The chief imports carried from the coast to the interior are salt, saltfish, cloths, opium, spices, glass bangles, &c.

Trade is almost exclusively carried on by means of pack-bullocks belonging to the wandering tribes of the Brinjarris, and the chief routes frequented by them are the following:—

- I. From the several salt-pans on the coast to Sálúr and Párvatipuram.
- II. Párvatipuram viâ Ryaguddah, Bisenkattak, and Ombadola to Santpur, Dádpur, and up the Tel Nadi and Mahánadi to Sónpoor and Sumbulpoor.
- III. Parvatipuram viâ Narrainputnum, Letchmipuram, Dasmatpur, Girliguma to Nárangpur.
- IV. Ryaguddah viâ Singapore and the Músa Ghât to Bondesor (Bhawánipatnam).
- V. Músa Ghât viâ Junágar and Déobhog to Noagarh and Rájim.
- VI. Bondesor viâ Daspúr, Manjhér, Karial, Torbor, Tarnot, Sirgidi, Karti to Arang and Raipur.
- VII. Sálúr, Kuraputi, Nárangpur, Omórkot to Kankér and Dhamtari.
- VIII. Omórkot, Raigarh, Risgaon, Machka, Sihóá to Dhamtari.
- IX. Kankér to Bustar.
- X. Bustar to Jeypur.
- XI. Jeypur, Sogaru, Padawa, down the Galikonda Ghât to Kasipuram.
- XII. Jeypur to Malkangiri and Moet.

(8.) POPULATION, AND LAND AVAILABLE FOR IMMIGRANTS.—The people in the jungles are almost wild, and live in a semi-barbarous state, partly by the chase. They are mostly miserably poor, and dwell in small huts built of sticks and thatch. The small garden plots and spaces round their huts are fenced in with stakes as a protection against wild animals. Their agricultural operations are of the most primitive kind, and they have barely enough to subsist on. In the more civilized parts, in the large villages and towns, and in the well-cultivated tracts, such as the Dhamtari Taluk for instance, the people are comparatively well-to-do; they live in better houses, and have enough to live on and to spare for export.

There are large tracts of the best soil, now covered by jungle and forest, which offer a very promising field for immigrants. Such tracts are to be found in the zemindaries of Karial, Patna, Bodosamar, Nara, and Suarnal, in the Noagarh and Kankér estates, as well as in Kálahundy, Jeypur, and Bustar.

21. I have much pleasure in recording my obligation to the authorities of the Central Provinces and to the Manager of the Bindra-Noagarh Estate, as well as to the Rajahs of Kankér, Bustar, and Jeypur, for the ready assistance rendered to the reconnoitring party in the matter of guides, coolies, camp supplies, &c.

22. As the expedition is drawing to a close, I request your authority to hand over all Government tents, tools, stores, instruments, &c., belonging to my party to the charge of the Executive Engineer at Vizagapatam.

Ordered to store them at Vizagapatam. 7th March. Unless I receive other orders, I propose to embark at Vizagapatam for Madras by the first steamer in April. Till then I beg that all communications may be addressed to me at Waltair.

NOTE.—I must ask your indulgence for the inferior calligraphy of this letter, and for all corrections, erasures, &c., as my writer is not very efficient.—K. F. N.

XIV.

A.

EXTRACT from Executive Engineer's Notes of Reconnoissance from Raipur to Nárangpur viâ Rajim, Bindra-Noagarh, Háthgaon and Omórkot, 185 miles, 4 furlongs. January 15th to February 5th, 1882.

January 15th, 1882. Raipur to Khandwa en route to Noagarh. Height of Raipur above M.S.L. 963 feet. Distance 14 miles, 2 furlongs, 137 yards. Thermometer 6 A.M., 55° F.; 11 A.M., 79°; 4 P.M., 79°.

Thermometer and aneroid readings.

55°
29-34

60°
29-34

58°
29-33

5 miles, 0 furlong, 187 yards. Dumurtuli,

60°
29-33

some waste land about here, but little compared to the extent of cultivation. The laterite soil is occasionally varied by black clay, full of cracks and fissures in its present dry state.

7th mile. Two culverts required, each with one vent 3 to 4 feet square. The general drainage is of an ordinary description; besides the bridges, noted as required in the report, about 4 to 5 culverts with vents, each 2 to 3 feet square, are wanted per mile.

68°
29-35

10th mile. The village of Nemhóra half a mile to the right; a fine tank by the roadside. There is much iron-stone gravel about; also some red sandstone and a kind of coarse clay slate.

72°
29-32

11 miles, 6 furlongs, 178 yards. Uparwara, village with tope, tank, gardens and wells. A stream (Taivar nullah), 20 feet by 7 feet, with clay and gravel in the bed, and well-defined banks; no rock visible. Fields of rice (harvested) and wheat (growing). Then a gentle rise in the ground; half a mile further a swamp, with a stream, 6 feet by 4 feet. Laterite soil.

76°
29-36

13 miles, 5 furlongs. A stream called Ghatórah, 15 feet by 6 feet, with perpendicular banks; bed laterite gravel.

78°
29-34

14 miles, 2 furlongs, 137 yards. Khandwa, village with tank, tope, gardens and extensive fields. Soil laterite. Height above mean sea level 1,001 feet. Rise from Raipur 38 feet.

80°
29-29

A good made road runs from Raipur to this and further too, but it becomes gradually more and more neglected the further it goes. Avenue trees have been planted by the roadside, but they are not prospering owing to the manner in which they are protected, i.e., about a cubic yard of earth is being heaped round the base, whereby the tree is deprived of the necessary moisture, and the roots grow above ground in the earth heaped round the tree.

January 16th. Khandwa to Rajim. Distance 11 miles, 2 furlongs, 118 yards. Thermometer 6 A.M., 57°; 11 A.M., 75°; 4 P.M., 80°. In the first mile occurs a small stream (Chittar nullah), 10 feet by 5 feet, in black soil, with muddy bed and high banks; a road bridge is about to be built here, for which red sandstone is being collected. The country is nearly all cultivated; there is very little waste land; the soil is mostly black; the chief crops are rice, wheat (ghóón), linseed (alsi), and Bengal-gram (chenna).

2 miles, 4 furlongs, 160 yards. Kolhán nullah, 20 feet by 10 feet; banks well defined; bed sandy with gravel. The village of Thanoud lies half a mile to the right; there is large tope near it; most of the villages here have fine topes; otherwise there are few trees about.

3 miles, 4 furlongs. On the summit of some gently rising ground a cross road running north and south. Topes and trees begin to occur more frequently than before, and there is some waste land about. Two small tanks by the roadside, and a young mango tope; extensive rice-fields.

5 miles, 3 furlongs, 154 yards. Sunderkhera, a large village with topes and tanks and extensive wet and dry fields. Soil chocolate coloured, with small stones and gravel (red sandstone); numerous mhowa trees about. The minor drainage required for the road is of an ordinary description, four to five culverts per mile, each 2 to 3 feet square, would suffice.

7 miles, 1 furlong. *Parsada*, a large village with a tope. Babul trees plentiful, especially by the roadside. Near the village is a nullah 35 feet wide and 8 feet deep, with gravelly bed and steep banks; no rock visible; soil black. A little further on two small tanks by the roadside. Linseed (alsi) is largely grown about here.

8 miles, 5 furlongs, 180 yards. *Village of Ghont*; a nullah 15 feet wide by 10 feet deep, with steep banks and soft bed, in black soil.

10 miles, 1 furlong, 175 yards. *Paragion*, a large village, with extensive groves of mango and tamarind trees and several tanks. Laterite rock is seen cropping out. Here the Mahanadi is crossed, about a mile above Noapara.

The river is 1,908 feet wide between the banks, but in floods the northern or left bank, which is low (about 15 feet high), is inundated; the southern or right bank is 25 to 30 feet high. The low water in the deep bed at present is 1 to 1½ feet deep and 200 feet wide, the bed is sandy, but there is laterite rock on both banks. There is an island, with a temple, just below the junction with the Pairi river. The temple is dedicated to Kolésa Mahadéo.

11 miles, 2 furlongs, 118 yards. Camp on southern bank of Mahanadi in a fine tope near a temple, on the out-skirts of the town of Rajim where a Zemindar lives. There is an Imperial Post-office, a Police station and a vernacular school here. The temple is considered a very holy one. The priests have in their possession three copper plates, joined by a copper ring with a seal; the plates are rectangular, measuring 12 by 9 inches, one-eighth of an inch thick, and bear an inscription in the Páli language; they are said to be very ancient and to contain the title deeds of the temple property. General Cunningham of the Archaeological Survey has seen them, and I believe taken a copy of the inscription.

Rajim is 917 feet above mean sea level. Fall from Khandwa 84 feet.

Distance from Raipur 25 miles and 5 furlongs. I halted two days at Rajim to dispose of some office work, as this is the last Post-office I shall meet until I get to Nárangpur.

January 19. *Rajim to Kopra*. Distance 10 miles, 1 furlong, 206 yards. Thermometer 6 A.M., 49°; 11 A.M., 75°; 4 P.M., 79°.

Mean aneroid reading at Kopra 29-23. Passed through the town of Rajim and its fine topes; then over some waste land with black soil, the ground full of cracks and fissures.

The country is open; topes, fields and villages are seen in all directions. The crops are chiefly wheat, linseed and Bengal-grass.

2 miles, 2 furlongs. *Village of Chobethandha*, with gardens, wells, topes, and fields; the latter mostly wet. The village of Sindheri was left half a mile to the right. Black soil.

4 miles, 2 furlongs. *Baronda*, on high ground, with light soil and some red gravel. Fields, gardens, tank and tope. The castor-oil plant, sugarcane, tobacco, and garden vegetables are grown. A spring channel (called Damahua nullah) beyond the village requires a small bridge, 10 feet by 5 feet.

There are numerous wells about here, near the bank of the Pairi river, by means of which vegetables are cultivated. The water in the wells is about 8 feet below the surface. The village of Chichond, with a mango tope, was left a quarter of a mile to the east.

The river Pairi here is very broad and shallow, has a very gentle fall and inundates the country on its right or eastern bank. In the 6th mile is a shallow sandy nullah which is subject to floods from the river, and requires a waterway of 45 feet by 4 feet.

6 miles, 2 furlongs. *Kuraskera*, with several mango topes and extensive gardens. In the latter are found chillies, brinjals, castor, onions, garlic, beans, pumpkins, mustard, tobacco, and sundry vegetables. Soil light loam.

8th mile. *Tira*, a small village, with gardens, topes and several small tanks. The soil continues of a light description. Half a mile beyond the village a young mango tope is being reared. In the 9th mile is another and larger plantation of young mango trees, which are protected by basket work fences and seem well attended to.

10 miles, 1 furlong, 206 yards. *Kopra*, a large village with extensive fields, gardens and topes on high ground and light soil.

The Noagarh hills and jungles are seen looming in the distance.

Kopra is 931 feet above mean sea level. Rise from Rajim 14 feet.

Distance of Kopra from Raipur 35 miles, 7 furlongs.

January 20th. *Kopra to Bourka*. Distance 12 miles. Thermometer 6 A.M., 49°; 11 A.M., 82°; 4 P.M., 78°.

The soil south of Kopra is alternately black and light; there are large rice fields; wheat is becoming scarcer; some waste land is seen, and some land lately reclaimed from the jungle.

At 1½ mile a stream is crossed, called Bhór nullah, 10 feet by 5 feet, with high banks and soft bed. The route lay along the bank of the Pairi river, which is here broad and shallow, and has very little fall. At 2½ miles the village of *Surkunda* with a tope, gardens and wells, and numerous cattle. Sugarcane and plantains are grown. Then begins jungle, as yet of a light description; a tank is passed; the village of *Panduka*, where there is a Police station, is left to the east. I did not go by the bandy track to Panduka, as I wished to keep along the river bank where the railway should be made; the bandy track crosses a small ghat near Bourka. The soil is mostly black and much cut up by cracks, fissures and holes.

Several large gangs of Brinjarri bullocks were met, carrying rice and wheat southwards. In the fourth mile a tank. Then the village of *Kutena* (4 miles 1 furlong). Some light jungle about here; and sandstone rock is seen cropping out. In the 5th mile begins the regular

jungle again, and gradually becomes denser. A small stream is crossed, 9 feet by 4 feet, with good banks and hard bed, a tributary of the Pairi river. Soil light. At 5½ miles occurs a large plantation of sugarcane on the river's bank. Near this a stream, flowing into the Pairi, 25 feet wide and 8 feet deep in flood, with steep banks and a good hard crossing. Here the gneiss formation begins again; no more limestone rock or sandstone; much gneiss rock is seen cropping out; kunkur nodules lying on the surface; there are some patches of cultivation in the jungle.

At the 6th mile are large rice fields on rather high ground in the jungle, rudely cultivated without visible means of irrigation, by rain water most likely, in the wet weather; they are now dry.

6 miles, 4 furlongs. *The village of Kúkda*. Some rice fields. Thin scrub jungle all round. Light clayey soil with sand. Some laterite is seen cropping out, but the prevailing rock is gneiss. In the 8th mile much rock occurs along the bank of the river, and the jungle becomes very dense. A few patches of swampy soil are met with, roughly cultivated. The route continues along the river's bank; the soil is alternately stony and swampy; some high rocky ground to the left. Jungle dense.

9th mile. A nullah, 12 feet by 5 feet, with steep banks and soft crossings; close by two smaller nullahs 7 feet by 4 feet each, another 9 feet by 4 feet, and a fifth 12 feet by 5 feet; the last four with stony crossings.

9 miles, 3 furlongs. *Páhpur*, the site of a deserted village, belonging to Bourka; a few huts are left standing; there are very few signs of cultivation about; the place looks an unmitigated wilderness. At 9½ miles, two small nullahs close together, each 9 feet by 4 feet; the ground here is broken, and the soil stony and rocky, the jungle dense, the grass high. The rocky hill side rises from the bed of the river, and some hill side cutting for about a mile would here be required for the road.

11th mile. A nullah, in a swamp, 25 feet by 6 feet. Banks ill defined; bed sandy.

12th mile. *Bourka*, a small village in a jungle clearing, a swamp partly cultivated, surrounded by rocky hills well wooded.

Mean aneroid reading at Bourka 29-21, height above mean sea level 992 feet. Rise from Kopra 61 feet. The place is spelt Bourka on the map, but the people pronounce it Bārka.

Distance of Bourka from Raipur 47 miles, 7 furlongs.

21st January. *Bourka to Dongriga*. Distance 9½ miles. Thermometer 6 A.M., 43° F.; 11 A.M., 80°; 4 P.M., 80°.

The rough bandy track, such as it is, leads from here over some gently rising flat ground, with hilly jungle on both sides, which offers no obstacles to road or railway. Some rude rice cultivation in a swamp on sloping ground is met.

The low hill ridges accompanying the track on either side are well wooded; the soil is hard and gravelly, much nodular kunkur limestone lies about on the surface. A little further on, the track leads for some distance along the slope of the ridge on the left, from which much drainage descends that crosses the road and will require a culvert, 3 feet to 4 feet square, per furlong.

There is not much rock here; what there is, is gneiss decomposed on the surface, and conglomerate. Near the end of the 2nd mile the line runs close to the bank of the Pairi river which is here shallow and broad, with but little fall, and overflows its banks.

2 miles, 1 furlong. *Stream* 10 feet by 4 feet; low banks and sandy bed. The track is cleared of jungle to a width of 15 to 20 yards, and the surface has been roughly improved for cart traffic in the dry weather.

At 2½ miles, two streams, not far apart, each 10 feet by 4 feet.

At 3½ miles a large clearing in the jungle with some cultivation. Not far from this is the village of *Karti*, on the other side of the river. *Kurubata* lies to the left, with a tank and extensive rice fields.

4 miles, 5 furlongs. *Village of Malga*, situated on the hill side, somewhat above the general level of the country.

5th mile; cross the Pairi river, here 1,530 feet wide. The bed is sandy and there is no rock visible. The northern bank is not well defined, low and subject to inundation during floods; the southern bank is steep and rises 12 feet above the bed.

The high floods are said in some years to rise 6 to 8 feet above this bank and to submerge the country up to the village of *Manjarkata*, which is at 6 miles, 1 furlong. On the southern bank of the river the jungle is largely cleared, some apparently quite lately, and the ground is well cultivated. The village of *Chikli* is left on the right.

Rice, sugarcane, Bengal-grass, linseed, castor-oil and tobacco, besides vegetables, are grown; wheat is no longer met. The soil is mostly black. A small tank (bhandhábúla) is near the track. Some sheet rock (gneiss) appears above the surface.

7 miles, 1 furlong. *Village of Amdt*, with some cultivated fields; then jungle again; the country here is quite flat. At 7½ miles a small nullah, 12 feet by 5 feet.

7 miles, 6 furlongs, 142 yards. A larger nullah 55 feet wide, with low perpendicular banks, 4 feet high, which are said to be covered by extraordinary floods to a further depth of 3 feet. The water-way required to be provided to pass such floods is more than twice that contained between the banks.

8th mile. *The village of Paraga*, where the Manager of the Noagarh estate lives; the young Rajah, a minor, being in school at Raipur. There is a Police station at Paraga. Some

good gardens are here; an avenue of young mango trees has been planted and is taken care of. From Paraga to Noagarh, a distance of 15 miles, there is uninterrupted jungle, without a single village. The villages that once existed have been deserted.

A swamp is met near Paraga; then the jungle begins, through which a track has been cleared 15 to 20 yards wide, and the surface has been improved for cart-traffic. There is much sheet rock about (gneiss) and some conglomerate, called Choári in Hindustani.

8 miles, 5 furlongs. A shallow nullah, 20 feet by 4 feet, with low banks and sandy bed.

9 miles, 3 furlongs, 105 yards. Dongriga, the site of a deserted village, near the Bamni Dévi rock (which looks like a ruined castle). There are no traces of cultivation left, the jungle grows all round the place, which is said to have been deserted by the villagers on account of the numerous wild animals about here.

The mean aneroid reading at Dongriga is 29.04 feet.

Height above mean sea level 1,130 feet.

Rise from Bourka 138 feet.

Distance of Dongriga from Raipur 57 miles, 2 furlongs, 126 yards.

January 22nd. Dongriga to Noagarh. Distance 13 miles, 1 furlong. Thermometer 6 A.M., 46° F.; 11 A.M., 86°; 4 P.M., 80°.

In the first furlong the Dongriga nullah is crossed, 35 feet wide and 7 feet deep in flood, with a sandy bed, but rock for foundations near; the banks are about 5 feet high and well defined, they are flooded in the rains.

The track through the jungle continues to be cleared to a width of from 15 to 20 yards, and is made passable for carts. The soil is alternately swampy and stony, and embankments will be required in several places. The ground level is slightly undulating, the drainage ordinary, mostly from left to right. The jungle is small but dense, there is no large timber in the first mile.

1st mile, a shallow stream 12 feet by 3 feet. At 1 mile, 3 furlongs, 146 yards, Tirnai nullah, a stream 35 feet wide at bottom and 5 feet deep, with low banks, sloping at 1 in 30, and sandy bed; no rock. There are some tall forest trees here in the jungle, matti (sája) and sál (sarai) predominating. Some rock is seen near the surface, chiefly gneiss; much quartz is lying about in fragments.

The soil is alternately hard and gravelly, then sandy or clayey loam.—Much tall young timber, chiefly sál; fine straight poles.

1 mile, 7 furlongs. A stream 9 feet by 3 feet. Ground undulating.

2 miles, 6 furlongs, 54 yards. Bugai nullah, a stream 35 feet wide with irregular, sloping banks and sandy bed; rock for foundation near at hand; the rock is a kind of decayed gneiss called "Darraputtar" in Hindi. Then some rising ground and stony soil.

3 miles, 1 furlong. A small drainage channel 6 feet by 4 feet, flowing to the left. In the same mile there are several more small drainages like the above, all leading from right to left. There is no cultivation here; all jungle and tall grass, upon a hard but fertile soil. Ample space for agricultural operations.

4 miles, 1 furlong, 40 yards. Aneroid reading 29.06. Korihardi nullah, a shallow stream with low irregular banks and sandy bed; probable section in flood 25 feet by 3 feet. There was a village of Korihardi here, some twenty years ago, which, the people say, has been deserted on account of the depredations of wild animals. The ground continues to rise gently; the jungle is tall, with little underwood, but high grass; the soil is hard and gravelly. Further on the ground undulates again, and some hill-side cutting will be required for the road; but not much. Good matti timber is abundant.

In the 5th mile is the Mogai nullah, draining to the right, and measuring 16 feet by 4 feet. The jungle here is hilly and stony, and the ground irregular. The track leads over the

Urtuli Ghát, a small ascent, about 120 feet in perpendicular height. The track is taken straight up the hill-side, while the new road or railway should keep lower either to the right or left where there is enough room for a gradient of 1 in 100. Much quartz is lying about the surface; reefs of it, and large veins in gneiss rock, occur in several places about here.

5 miles, 5 furlongs, 187 yards. Head of the Urtuli Ghát.—Aneroid reading 28.93. From here the track descends again; but, as before stated, the railway need not be taken up so high as this. Further on, the ground becomes flat again, only now and then gently undulating. Some grassy plots—pretty glades—are seen here and there in the jungle; they are swampy in the rains, and suspect.

Aneroid 28.97.

6th mile, a nullah draining to the right, 5 feet by 3 feet; black soil. Then some gently rising ground.

8 miles, 4 furlongs; a nullah, 6 feet by 4 feet, in stony soil.

9 miles, 1 furlong, 172 yards. Summit of low rise.

Aneroid 28.95.

Some broken and irregular ground; stony; a small drainage culvert required 3 feet square; another 7 feet by 3 feet.

10 miles, 1 furlong, 152 yards. Teregi nullah, 15 feet wide and 9 feet deep, in soft soil, with steep banks; no rock. Much young sál-wood grows here, good straight poles, 50 feet high and 1 foot in diameter. The jungle consists largely of sál; there are also many matti trees. No bamboo is seen about here.

Aneroid 28.93.
Thermometer 72°.

Aneroid 29.01.
Thermometer 80°.

11 miles, 5 furlongs. A nullah 12 feet by 5 feet, in a swamp. Then again good, hard soil. Some undulating ground, involving cuttings and embankments, and occasional hill-side cutting; but only on a small scale.

12 miles, 5 furlongs, 110 yards. Harpai nullah, 25 feet by 7 feet, sandy bed; steep banks; rock for foundations. Here the track to Kusmi branches off to the south-west. Much sheet rock (gneiss) cropping out between this and Noagarh.

Aneroid 28.97.
Thermometer 84°.

13 miles, 1 furlong, Noagarh, a small village, containing about 40 mud huts, besides the Zemindar's buildings (which are also of mud, timber and thatch); situated at the foot of a rocky hill which has a temple. The village and its fields are placed in a confined, ill ventilated space, on irregular ground, with rocks and swamps about, and three or four stagnant tanks.

11.30 A.M.
Aneroid 28.96.
Thermometer 85°.

There is no need for bringing the railway to Noagarh; it can be taken over lower and better ground between this and the river Sondor, some 4 or 5 miles west of Noagarh; or better still, entirely along the river, i.e., within half a mile or so of the bank.

January 23rd. Halted at Noagarh, and despatched one camp ahead to Balétma, which is on the Sondor river.

The mean reading of the aneroid battery at Noagarh is 28.82; height above mean sea level 1,314 feet.

Rise from Dongriga 184 feet. Distance of Noagarh from Raipur, 70 miles, 3 furlongs, 154 yards.

January 24th. Noagarh to Baltema. Distance 10 miles, 6 furlongs, 131 yards. Thermometer 6 A.M., 57°; 11 A.M., 78°; 4 P.M., 82°.

Returned to the Harpai nullah, where the track to Kusmi branches off. From here the ground becomes somewhat irregular and the jungle is pretty dense; the soil as a rule is light and sandy, rather stony, occasionally rocky; the drainage is of an ordinary description and runs from left to right. The track leads up and down, but mostly up-hill at easy gradients. Some hill-side cutting would be required, but not much.

Detached Aneroid 28.94.

At 1 mile, 2 furlongs, 165 yards, the summit level of the rise is reached.

1 mile, 4 furlongs. Murgi nullah, 15 feet by 4 feet. Much young sál-wood and high grass.

2 miles, 1 furlong, 168 yards. Teregi nullah, 15 feet by 7 feet; the same that was crossed on the 22nd at a lower part of its course. Here is an abundance of quartz, white, pink, red and black, scattered about the surface. The soil is hard and gravelly. Both the Murgi and Teregi nullahs flow from left to right, have steep banks, a rapid fall and sandy beds with stones.

2 miles, 6 furlongs. A clear spot in the jungle, somewhat swampy; the site of the deserted village of Bardul, said to have been left by the people 10 years ago on account of the numerous wild animals about. But this is scarcely a satisfactory explanation; there must be some other cause for this and other villages in these parts being deserted. Not a vestige of a house remains at Bardul, and scarcely any sign of cultivation, except the jungle clearing. The ground here is no longer hilly, but flat.

3 miles, 5 furlongs. Satigat nullah, 60 feet wide at bottom, 8 feet deep; bed sandy, with gravel and loose stones. Banks high, and sloping at an angle of about 45°. The soil here is light sandy loam, on which grows the ordinary jungle and some tall grass. The track has been cleared of trees and bushes, 5 to 6 yards wide, and is passable for carts.

In the 4th mile is a large area of deserted fields in the jungle which have apparently not been cultivated for some years; this belongs to the village of Kusmi.

4 miles, 2 furlongs, 190 yards. Kusmi nullah, 60 feet by 8 feet, of the same size and nature as the Satigat nullah in the 4th mile.

4 miles 4 furlongs. A small drainage channel 6 feet by 2 feet.

A temple of Mãte Dévi, i.e., a rude mud-and-thatch hut, surrounded by wooden palisades as a protection against intruders, both men and animals. Then another small streamlet, 6 feet by 2 feet.

5th mile. Village of Kusmi, consisting of about 25 huts, containing 60 people, in a large jungle clearing, with extensive wet fields on rich soil; a small tope and a good herd of cattle. Then jungle again, at first light scrub, then dense with young sál and some matti trees. Soil, light sandy loam; a few masses of gneiss rock showing above the surface. On the left, about a mile off, is a hill, marked on the map 2,366 feet high, or about a thousand feet above this village. Between this and the 7th mile four larger culverts are required, averaging 7 feet by 3 feet.

7 miles, 5 furlongs. Village of Boirga, six huts in a small jungle clearing, enclosed by palisades as a protection against wild animals. Very little cultivation, although the soil is good. There are signs of sambhur, bison, and wild pig about. Next to the village is a swampy glade: a grass plot in the jungle, on black soil, which will be difficult to pass in the rains. Two furlongs further a track, i.e., a foot-path, branches off to the right, leading to Amaróra, through a young sál forest 10 to 15 years old, with tall grass. The path we follow is very slender, sometimes scarcely visible, but the grass and brushwood along it have been cleared a little by the party sent on yesterday.

9 miles, 2 furlongs. Kolhóra nullah, 15 feet wide at bottom, 4 feet deep; banks sloping at an angle of 30°; sandy bed, but rock for foundations at site. The rock is gneiss (in Hindi, Gaunha). All jungle, no cultivation. Ground slightly undulating.

9 miles, 5 furlongs. Budra nullah, 35 feet wide, 6 feet deep; steep banks; sandy bed, no rock.

Tall grass, 7 to 10 feet high.—A swampy glade; then again jungle of young sál trees, with scrub and brushwood. Indeed, for the last 40 miles of this march the country has been one uninterrupted jungle, except at the few miserable villages met.

10 miles, 4 furlongs. Amajóri nullah, 25 feet wide, greatest depth 5 feet.

One bank high, the other low and flooded; bed sandy, no rock visible.

10 miles, 6 furlongs, 131 yards. Baltéma, a wilderness with eight miserable huts, built of sticks and thatch, inhabited by about 20 people all told, most of whom had run away last night at the approach of the advance camp; no signs of cultivation to be seen.

Mean reading of aneroid battery at Baltéma 28.83; height above M.S.L. 1,295 feet. Fall from Noagarh 19 feet. Distance of Baltéma from Raipur, via Noagarh, 81 miles 2 furlongs, (deducting 1 mile for the distance, from Harpali nullah to Noagarh, travelled over twice). But along the Sondor river—where the railway should go, instead of via Noagarh—the distance is only 75 miles and 2 furlongs.—Baltéma has a reputation for tigers. The Manager of the Bindra-Noagarh estate, who was most solicitous for our welfare, furnished each tent in camp and each horse with a guard of two jungle men to keep the tigers off. Firewood was plentiful, and the guards slept peacefully, roasting themselves within a few inches of the blazing fires. No tiger came.

January 25th. Baltéma to Tumaribahál.—Distance 12 miles. Thermometer 6 A.M., 50°; 11 A.M., 84°; 4 P.M., 84°.

Passed through low scrub jungle, with young sál trees and tall, thick grass over rich, dark soil that must be swampy in the rains. In the first half-mile crossed two small drainage channels, 5 feet by 3 feet; the ground in parts uneven.

1 mile, 2 furlongs. Pendra, a village partly deserted, and rebuilt on another site. Soil reddish, sandy loam with gravel. Then three small nullahs, 5 feet by 3 feet; the ground still uneven.

1 mile, 6 furlongs. A small stream, 10 feet by 4 feet, with clear water running in it.

2 miles, 2 furlongs. The present village of Pendra in a new clearing.

2 miles, 4 furlongs. Maria nullah, 10 feet by 3 feet; uneven and broken ground.

2 miles, 6 furlongs. Parsá páni nullah, 15 feet by 4 feet. Much quartz about here.

3 miles, 70 yards. Jámun nullah, 9 feet by 3 feet. A little further on a 3-foot culvert is required.

3 miles, 5 furlongs. Pulbhari nullah, 25 feet by 4 feet; perpendicular banks, sandy bed; some rock for foundations near.

3 miles, 7 furlongs. Sarai nullah, 12 feet by 4 feet. Sál jungle and tall grass. Traces of bison, sambhur, pig and bear.

4 miles, 2 furlongs. Jarr nullah, 20 feet by 5 feet, with steep banks and rocky bed. The track (which is barely visible) here crosses a number of spurs running out from the hills on the left.

4 miles, 4 furlongs, a small drainage channel, 4 feet by 2 feet. Ground uneven; a succession of spurs; soil hard and stony. The railway should keep close to the river's bank. A hill covered with fragments of quartz, near the right bank of the Sondor, about opposite the village of Jounra which is on the left bank.

4 miles, 5 furlongs. Small nullah, 4 feet by 2 feet. The soil is quartz gravel.

4 miles, 7 furlongs. Chická hi nullah, 15 feet by 3 feet; rocky bed. The rock is gneiss, with patches and veins of pink quartz, alternating with conglomerate.

5th mile, small nullah 8 feet by 3 feet.

5 miles, 2 furlongs. Gobra, a deserted village; the ten huts, built of sticks and thatch, remain standing, (the walls are made of sálwood poles placed perpendicularly in the ground; they are 4 feet high at the sides and 8 feet up to the ridge pole; sometimes the spaces between the sticks are closed with mud, but not always. There is only one opening: a door 4 feet by 2 feet). The people are said to have left about four months ago on account of sickness. No clearing or traces of cultivation near.

5 miles, 3 furlongs. A 3-foot culvert required.

Soil stony: quartzose, gneiss, and conglomerate.

5 miles, 7 furlongs, 205 yards. Gógor nullah, 8 feet deep, 60 feet wide; steep banks; level, sandy bed with some rock; a good bridge site is available 2 furlongs higher up the stream which there flows over solid rock between steep rocky banks.

The jungle about here is dense and looks very wild; there is, besides the trees and bushes, tall coarse grass of two kinds, some with thick round stems, some with long flat leaves; the slender path is barely visible:

6 miles, 5 furlongs. Kátipára, site of a deserted village said to have been left three years ago. Good, fertile soil.

Here is the boundary of the Noagarh estate. We now pass into the Sihóá Ilága of the Dhamtari Tháseel.

The country is flat again and the ground even. At the 7th mile a marshy glade in the sál jungle. A little further on the soil is sandy clay with fine gravel.—Some uneven ground again.

7 miles, 4 furlongs. Two culverts required, 4 feet by 3 feet.—Then some sheet rock (gneiss). Fine young forest, chiefly sál.

8 miles, 3 furlongs, 110 yards. Burrpáni nullah, 10 feet by 4 feet. Wild jungle and tall grass.

In the 9th mile two small nullahs, 5 feet by 3 feet. Ground flat, sometimes swampy.

9th mile. Mára Córa nullah, 10 feet by 4 feet. Grand old forest, chiefly of sál and matti; but little brush and underwood.

10 miles, 3 furlongs, 170 yards. Junction of Dhour and Sondor rivers.

Cross the Dhour 100 yards above the junction, 65 feet wide, 9 feet deep in flood, steep banks, sandy bed, no rock.

10 miles, 6 furlongs. Tennai, three or four small huts of sticks and thatch in a jungle clearing. There are signs that the place has been better inhabited formerly. A 4-foot culvert required.

11th mile. Signs of former rice-fields in a clearing; soil dark and swampy.

12 miles. Tumaribahál, a small village of a dozen huts, with some gardens and a few rice-fields. Castor, pumpkins, beans, hybiscus, chillies, brinjals and tobacco are grown near the huts. Young mango trees have been planted and are fenced in by upright sál poles, 6 inches thick and 6 feet high, being let into the ground and forming a circle round the tree 3 feet in diameter. This is a very effective protection and gives the young trees enough light, air and moisture. The village is near the right bank of the Sondor river, which is here 150 feet wide and 10 feet deep in flood, and has regular and steep banks, and a sandy bed with rock here and there. A very good encamping ground on the river bank, in an old clearing planted with young mango trees.

The mean reading of the aneroid battery at Tumaribahál is 28.66. Height above mean sea level 1,441 feet.

Rise from Baltéma 146 feet.

Distance of Tumaribahál from Raipur 93 miles 2 furlongs.

January 26th. Tumaribahál to Risgdon. Distance 10 miles, 5 furlongs, 170 yards. Thermometer 6 A.M., 48°; 11 A.M., 87°; 4 P.M., 84°.

The track leads along the bank of the Sondor, through stately jungle.

In the 6th furlong Mudibahal, a deserted village; a few sticks left standing; the people are said to have moved their village to another site.

First mile, a few solitary ploughed fields in the jungle. Ground flat; soil light and soft; sandy clay; jungle thin with some clearings and natural grass plots. A water course, 5 feet by 3 feet, in a small swamp, just outside the village of Kasrór.

2 miles, 4 furlongs, 152 yards. Kasrór, four huts containing about twenty inhabitants; a few fields, no gardens. A blacksmith is in the village. The people here still speak Chattisgarhi, a dialect of Hindi.—High hills to the left, a peak is marked 2,445 feet on the map.

3 miles, 100 yards. Kámunkór nullah, 15 feet by 4 feet; steep banks, soft bed. Tall rank grass, then forest of sál; ground slightly undulating.

3 miles, 2 furlongs. Kauribahár nullah, 15 feet by 5 feet. Soil light sandy clay.

4 miles, 194 yards. Tál Dhorigi nullah, 20 feet by 5 feet; steep banks; bed, hard soil and gravel.

4 miles, 4 furlongs, 160 yards. Bórporór village, fifteen huts with sixty inhabitants; rice-fields and gardens; some date-palms; south of the village the Katasaru nullah, 25 feet by 5 feet, partly dammed up and converted into rice-fields.

5 miles, 2 furlongs. Kunnár nullah, 20 feet by 5 feet, with clear running water; rocky bed; banks sloping at an angle of 45°. Then some undulating ground with young sál jungle.

5 miles, 7 furlongs. Thurra nullah, 15 feet by 5 feet. Underwood and grass very thick; no track; some people have to go ahead to clear a path; slow progress.—Small drainage channel, 6 feet by 3 feet.

6 miles, 6 furlongs. Káser nullah, 12 feet by 5 feet, a stony water course with rocky bed. A good deal of rock about here, and the ground somewhat undulating; a high hillock to the left, half a mile distant.

7th mile. Urai nullah, 8 feet by 3 feet. Undulating and stony ground.

7 miles, 3 furlongs, 146 yards. Lafni nullah, 18 feet by 5 feet, with a rocky bed. Much quartz in small fragments about the surface.

7 miles, 7 furlongs. Kíssi nullah, 15 feet by 4 feet.

8th mile; a small ploughed field, quite solitary in the jungle.

8 miles, 3 furlongs, 100 yards. Karka, a small village containing five huts with 25 people; some fields and gardens. The people here speak Ghóndi besides Chattisgarhi. A man addressed me as "Máprábu," instead of Jíhó or Máháráj, as hitherto.

8 miles, 6 furlongs; cross the *Bag nullah* (near its confluence with the Sendor), 50 feet wide, 9 feet deep; steep banks, sandy bed, no rock. Brinjarris with gingelly-seed going to Párvatipuram, others with salt coming from Sálúr. The latter said they had been 25 days from Sálúr and would take 10 or 12 days more to reach Dhamtari.—

(Risgaon is in the regular trade route from Sálúr and Párvatipuram to Dhamtari and Raipur).—They go from Risgaon, via Kálgád, Sankra, Ránigáon, Malleri, Sirsáda, Sihóá, Sémra, Birgúdi, Gatigáon, Gatásili, Dókal, Bambagowd, Kukrel, Bhoína, Achóta and Koliari to Dhamtari. But this route is not suitable for a railway on account of the irregular ground it passes over.

10 miles, 5 furlongs, 170 yards. Risgaon, 15 huts with 60 people. Fields, gardens and a tamarind grove. The camping ground is small and too near the village, also near a swamp; but the headman (or Malcúzar) said the place was healthy.

Mean reading of aneroid battery at Risgaon 28.53.

Height above mean sea level 1,569 feet.

Rise from Tumaribahál 128 feet.

Distance of Risgaon from Raipur 104 miles.

January 27th. Risgaon to Háthgaon.—Distance 8 miles, 7 furlongs. Detached aneroid 28.63. Thermometer 6 A.M., 44°; 11 A.M., 77°; 4 P.M., 82°.

There had been heavy dew at night, and it was a crisp, cold morning. This day we had to ascend some of the last steps to the Jeypur plateau, to which the valley of the Sendor river has been gradually leading up. The track in the first furlong lay through a swamp drained by a nullah, 20 feet by 5 feet. The jungle at starting was light, with some swampy ground in places. At the 7th furlong is the site of the deserted village of Kurudi, said to have been abandoned on account of depredations and

Aneroid 28.61.

exactions committed by the Brinjarris. The sál jungle around is pretty, with occasional grassy glades; there are some young teak trees in the jungle; the soil is light sandy loam, except in the swamps and glades where it is dark, stiff clay.—All jungle.

2 miles, 4 furlongs. A small drainage 6 feet by 3 feet; half a mile further three more nullahs like the last. The ground is slightly undulating and steadily rising, but gently. Aneroid 28.57.

3 miles, 5 furlongs, 117 yards. Paudripáni nullah, 10 feet by 4 feet. Fine tall jungle, and forest trees; aneroid 28.58.

3 miles, 6 furlongs, 150 yards. The track crosses the Soroá river, 65 feet wide at bottom, 10 feet deep in flood; sandy bed with some rock; one bank low and flooded, the other high and steep. This river need not be crossed by the railway which should keep on the right bank.

4 miles, 1 furlong. The site of Gourgaon, a deserted village; the people are said to have left on account of Brinjarris, and settled in another place away from the beaten track. A number of young mango trees are planted on the site, and fenced in by upright sálwood poles, 5 to 6 feet high. The soil is rich clay. Aneroid 28.57. The country here is flat; hills are seen in front and to the right. There are some rice fields, belonging to Gourgaon, which have not apparently been cultivated for some time.

4 miles, 4 furlongs, 145 yards. A deep nullah, 15 feet by 5 feet; in clayey soil. Then low scrub jungle, and coarse long grass.

At 5 miles, 1 furlong, the track crosses the Soroá river again; but the railway would remain on the right bank, as explained *supra*. Along this right bank the railway should be taken up to Samrathdéli and Dindandi, towards Kóliapodór and Raigarh.—Here is fine old forest, with large matti and sál trees, also some teak. The ground is undulating and irregular for some distance; then it becomes flat again. The soil is rich. Sál jungle continues.

At the 7th mile we leave the Central Provinces and enter Jeypur territory. Aneroid 28.47.—A drove of pack-bullocks, from Sálúr to Dhamtari, with salt.

7 miles, 4 furlongs; a small drainage to the left, 8 feet by 3 feet. Then some undulating ground.

8 miles, 6 furlongs; a swamp with black soil. Forest of matti and sál.

8 miles, 7 furlongs. Háthgaon, a small village containing five huts and about 25 people, who are not so miserably poor as in some of the villages met along the route for several days past. There is quite a flock of small children, and the headman is building himself a new and roomy hut. The people here speak Ooriya, and the headman is building himself a new and roomy hut. The people here speak Ooriya, and the headman is building himself a new and roomy hut. The people here speak Ooriya, and the headman is building himself a new and roomy hut.

Chattisgarh Hindi; but they understand Hindustani well enough.—No arrangements had been made here by the Jeypur agency for supplies, &c., for the party; and the Manager of the Bindra-Noagarh estate continued to afford his assistance.

No ghát, except the small Urtúli Ghát (on the 22nd) which can be circumvented, has been encountered on this route so far, and no sudden changes of level; the ascents have been gradual and easy, the undulations of the ground but slight; nothing to constitute an obstacle to the railway. The gradient need nowhere exceed 1 in 100. The jungles are magnificent, the soil is good; but villages are few and far between, and the population is exceedingly sparse. There are hundreds of square miles of good forest land in the Bindra-Noagarh estate that might be colonized, with advantage alike to the colonists and to the administration.

The mean reading of the aneroid battery at Háthgaon was 28.22.

Height above mean sea level 1,870 feet.

Rise from Risgaon 301 feet in 9 miles; about 1 in 150 or 33½ feet per mile.

Distance of Háthgaon from Raipur 113 miles.

January 28th. Háthgaon to Raigarh.—Distance 11 miles. Detached aneroid at 6 A.M. 28.38. Thermometer 6 A.M., 50°; 11 A.M., 86°; 4 P.M., 81°.

On leaving the village the track crosses a swamp and some rice fields; then through high grass and jungle, chiefly sál. There is a steady ascent which can be eased by keeping along the Golária nullah to the left. In the first mile we rise about 40 feet, the aneroid at the end of it reading 28.34. Then come repeated ascents and descents (but not very steep or high) which, combined, the Brinjarris call the *Parandri Ghát*.

At 1 mile, 4 furlongs, 109 yards, the aneroid reads 28.24; then we descend again; then another rise; then down and up again. On the last summit (at 2 miles 57 yards) the aneroid reads 28.23. After that we go down once more and cross the *Kurudidodi nullah*, 10 feet by 3 feet; at 2 miles, 1 furlong, 165 yards. Then ascend again. From here a track branches off to the right to Kósampur; there is some rock about.

At 3 miles, 2 furlongs, another summit is reached where the aneroid reads 28.19, showing a total rise from Háthgaon of 200 feet; from here the track leads steadily downwards. The jungle consists of tall matti and sál trees.

At 3 miles, 6 furlongs, the Mongosáriali (or Golária) nullah is met (25 feet by 5 feet) where the aneroid reads 28.27, showing a rise from Háthgaon of only 100 feet in 3½ miles. This is the nullah along the banks of which the track should be taken down to the Soroá river (*ride notes on the 27th, at 5 miles 1 furlong*).

From here begins another gentle ascent, and then come a few slight undulations with two swampy glades draining to the left into the Golária; until at 5 miles 4 furlongs we arrive finally on the Jeypur plateau, and the flat country stretches far away to the south. Met 300 pack-bullocks, taking salt from Sálúr to Raipur.—At the edge of the plateau (aneroid 28.16) there is some dense, young sál jungle, with a thick undergrowth of stunted dates and other bushes and tall grass, the whole forming a tangle almost impenetrable. Then begins a long swampy glade, partly cultivated, about half a mile wide, and extending southwards for miles, bordered with sál jungle east and west; the Poragora hills looming in the distance, where there is said to be good black-wood timber and iron stone.

6th mile. Village of Karaberra. Aneroid 28.16. Soil, dark clay.—We are now in the campaign country of Jeypore.

7 miles, 3 furlongs. Kóliapodór, with twenty houses and about 100 inhabitants. The homesteads have large compounds enclosed by fences of upright stakes; there are some vegetable gardens. The people here speak Ooriya. The track leads along the eastern edge of the great swampy glade, through low scrub jungle and young sál.

At 8 miles, 6 furlongs, where the aneroid reads 28.18, the swamp is crossed; the country continues flat, while swamp and jungle occur alternately along the track. The soil gradually becomes lighter and harder as we get away from the large swamp.

At 11 miles, 100 yards, Raigarh; with a fine mango topé, good encamping ground and the remains of an old mud fort. Here are about 40 houses, containing 150 people; all Hindus, no Mussulmans or Ghonds.

The detached aneroid reads 28.16; while the mean reading of the battery is 27.98. Height above mean sea level 2,101 feet. Rise from Háthgaon 331 feet. Distance of Raigarh from Raipur 124 miles.

The Manager of the Bindra-Noagarh estate, who had accompanied the party up to this and made himself very useful, returned from here.

The Amin of Onorkót was here to look after supplies, &c.

Halted at Raigarh on the 20th.

January 30th. Raigarh to Bérá. Distance, 11 miles 4 furlongs. Thermometer 6 A.M., 55° F.; 11 A.M., 81°; 4 P.M., 83°.

Near the village a tank bund is crossed or rather a dammed-up swamp; then begins the jungle again. There is a well trodden track; the soil is hard brown loam, with laterite cropping out in places; also some gneiss rock. Then jungle and swamp, the latter cultivated in places, alternately. The jungle is chiefly sál; some of the swamps must be nearly impassable in the rainy season.

At 3 miles, 2 furlongs, the site of Kandi, now deserted. The villagers are stated to have moved to another spot on account of the Brinjari traffic along the track troubling them. Here is a tank which is said to be never dry, and a temple to the goddess Mátá. There is a large swamp near, which has been cultivated. Then jungle again, young sál and scrub.

In the 5th mile we pass into a fine forest of old and young trees, chiefly matti and sál, with some black-wood and yégi, and very little underwood. The forest continues for miles, interrupted here and there by grassy glades, which are swampy in the rains. The soil is fertile and the lay of the ground easy for a road. The track leads for several miles through beautiful forest over level ground, on a water-shed, and encounters very little drainage. Here is some of the finest forest I have seen on this expedition; it has apparently never been touched by the hand of man and might be called primeval.

In the 7th mile the ground is slightly undulating; the soil in the lower parts is rich, dark clay; on the higher ground light brown and sandy.

In the 10th mile the ground descends gently towards Béra; the soil is sandy loam. At 10 miles, 4 furlongs, we emerge from the great forest and enter small jungle. At 10 miles, 5 furlongs is a large clearing where the village of Béra formerly was.

The people are said to have shifted to another site, not far from this, some years ago, when the Police was first introduced here. There are extensive rice fields; a ledge of gneiss rock shows above the surface in two places.

11 miles, 4 furlongs. Béra has about 15 huts and 40 inhabitants. It is situated near the Tél Nadi, which is here 40 feet wide and 8 feet deep between the steep and soft banks, subject to floods which inundate the swamp on both sides. The drainage encountered on this day's march was very little, as the track led for the most part along the ridge of a low water-shed, from which the country falls away in scarcely perceptible slopes to the right and left. All glades and swamps, along which the drainage runs, will of course require embankments, with culverts or small bridges. There is a good encamping ground on the old site of Béra, and a smaller one on the bank of the Tél Nadi, in a loop formed by the river, by the side of the track.

The mean reading of the aneroid battery at Béra is 28.15. Height above mean sea level 1,967 feet. Fall from Raigarh 134 feet. Distance of Béra from Raipur 135 miles, 4 furlongs.

January 31st. Béra to Omorkót. Distance 7 miles, 4 furlongs. Thermometer 6 A.M., 48°; 11 A.M., 77°; 4 P.M., 81°. In the first furlong the Tél Nadi is crossed, 40 feet by 8 feet between the banks, which are subject to floods, for some distance, to a further depth of at least 3 feet. Then jungle and high grass; some rising ground; a drainage channel flowing to the left, about 4 feet by 2 feet. At the 5th furlong is the summit of the rising ground, about 12 feet above the starting point; then two small nullahs, 5 feet by 3 feet.

Stately primeval forest of grand old trees; dead trunks are lying about where they fell years ago, some quite decayed, apparently never touched by man. Ground slightly undulating. At 2 miles, 2 furlongs, a glade draining to the left. Embankment required, with a culvert, 6 feet by 3 feet.

Three miles, 1 furlong. Barja; two small villages containing together about 50 houses and 150 people. The large farm yards are fenced in with palisades as a protection. South of the village common jungle again; no longer the fine old forest.

At 3 miles, 5 furlongs, a large swamp, more than a square mile in area; partly banded up and converted into a tank, with extensive fields under it belonging to Barja. The tank might be improved and irrigation extended. From this swamp flows a nullah called Bakuli. Then thin scrub jungle, on light sandy loam. At the 4th mile another swamp and a clearing in the jungle; then low scrub jungle again.

5 miles, 3 furlongs; a clearing and swamp; then light jungle with some fields; then a ploughed swamp. It is mostly good, rich soil between Béra and Omorkót, classed as No. 1 by the Revenue Surveyors.

7 miles, 3 furlongs. Bhaskel nullah. Steep banks; hard bed; no rock; 40 feet wide between the banks, which are 8 feet high and covered during great floods to a further depth of 3 feet, for some distance.

7 miles, 4 furlongs. Omorkót, a considerable village with a Police station, and the headquarters of an Amin. Here I met Mr. Cormac who had marched from Raipur via Dhamtari and Kankér. His own report on his reconnaissance accompanies these notes.

Mean reading of aneroid battery 28.12. Height above mean sea level 2,021 feet. Rise from Béra 54 feet.

Distance of Omorkót from Raipur via Rajim and Hāthgaon 143 miles; * via Dhamtari and Kankér, 150 miles. Good camping ground in tope; good water from the Bhaskel nullah. Halting at Omorkót on the 1st February.

February 2nd. Omorkót to Bijepur. Distance 12 miles, 4 furlongs. Thermometer 6 A.M., 52°; 11 A.M., 86°; 4 P.M., 79°. The track enters the jungle at once; there is some rock; the soil is light sandy loam. In the 2nd mile the village of Dongrigura; with a small irrigation channel called Jūnapāni.

At the 3rd mile a swamp with some cultivation; rich, dark soil all around. 4 miles, 1 furlong; the village of Sāna Borondi; then across a swamp, past a newly planted mango tope. Then a tank near the village of Boro Borondi.

5 miles, 1 furlong. Boro Borondi, with some vegetable gardens, and a wooden temple (i.e., merely a rude framework) to the goddess Bhīma (Kālī?).

There is also a sacred swing, with numerous sharp nails driven through the seat from below; on these nails good and holy persons are said to be able to sit without injury, and some do so at great festivals. But none of my people would try it.

6 miles, 3 furlongs, 124 yards. Nāgi river; steep banks and gravelly bed; no rock; 80 feet wide and 15 feet deep. This river should be bridged a mile to the east of the present track, to avoid crossing twice as the track does. Some laterite cropping out here.

7th mile, Dobra village. Fine tope and two tanks. Extensive rice fields. Numerous cattle. Then light jungle and clearings alternately.

9 miles, 4 furlongs, village of Tētarpaon. Then a swamp. Further on, the ground is gently undulating.

* Note.—By avoiding Nēsgirh and keeping along the Soudar river this distance is reduced to 137 miles.

10th mile. The village of Bokra to the right. Scrub jungle; another swamp. Then small sal jungle.

11 miles, 6 furlongs. Chatagura village. Then some low swampy ground. 11 miles, 8 furlongs; cross the Chatringi river, 45 feet by 12 feet; in soft sandy soil. Then a swamp again.

12 miles, 4 furlongs. Bijepur, with a splendid old tope of different kinds of trees, but chiefly mango and fig. The village is very insignificant now, but Bijepur is said to have been once a great place and the residence of a Rajah.

Mean reading of aneroid battery 28.14. Height above mean sea level 1,955 feet.

Fall from Omorkót 66 feet.

Distance of Bijepur from Raipur 155 miles, 5 furlongs.

February 3rd. Bijepur to Dabgaon.—Distance 10 miles, 6 furlongs. Thermometer 6 A.M., 52°; 11 A.M., 75°; 4 P.M., 77°. We enter sal jungle; at 1 mile, 4 furlongs cross a swamp; then sal jungle again, with occasional glades, each glade or swamp requiring an embankment and one or more culverts. The soil varies from dark, stiff clay to light, sandy loam; with red soil and gravel here and there.

In the 4th mile a large swamp, partly banded up for cultivation.

4 miles, 2 furlongs; passed village of Nakjor.

At 5 miles, 2 furlongs; a swamp, with a drainage requiring a culvert 9 feet by 4 feet.—All small sal jungle.

6 miles, 3 furlongs. Beldari nullah, 35 feet by 15 feet. Steep soft banks; sandy bed; no rock.

7 miles, 4 furlongs. A swamp about 100 yards across. From here a path is cleared through the jungle, 8 to 10 yards wide; the surface has been smoothed, and side drains cut. Fine sal forest again. Then some undulating ground, where cuttings and embankments will be wanted; but nothing on a large scale. A nullah 9 feet by 3 feet.

8 miles, 7 furlongs, a swamp, with soft black mud. Then jungle again, soil sandy loam.

9 miles, 4 furlongs, a deep swamp, where a considerable embankment and a bridge, 20 feet by 10 feet, will be wanted to let the drainage pass through.

10 miles, 6 furlongs. Dabgaon, with 30 houses and 100 inhabitants; a Police station. Good encamping ground in a mango tope. Water fair.

Mean reading of aneroid battery 28.12.

Height above mean sea level 1,983 feet, rise from Bijepur 28 feet.

Distance of Dabgaon from Raipur, 166 miles, 3 furlongs.

February 4th. Dabgaon to Pāparhandi.—Distance 11 miles. Thermometer 6 A.M., 51°; 11 A.M., 75°; 4 P.M., 77°.

3 furlongs, 106 yards. Ongi nullah, 60 feet by 14 feet, both banks subject to flooding; sandy sides and bed; no rock. A rude foot-bridge, well above high water, has been provided for this and some other large nullahs.—All jungle.

2nd mile. Village of Moideri, on somewhat irregular ground; large rice fields. Other crops: gram, ragi, mustard, castor, tobacco, and garden vegetables.

Then a swamp requiring an embankment with a culvert, 10 feet by 4 feet. Fine sal forest again.

3rd mile, a drain, 5 feet by 3 feet required.

4th mile, some undulating ground.

5 miles, 2 furlongs. Barigura, village. Then jungle again.

6 miles, 6 furlongs. Jelabahal village. Then a swamp.

7 miles, 1 furlong. Basni nullah, 90 feet wide and 12 feet deep; sandy bed; ill defined, soft banks; no rock.

A temporary foot-bridge is laid from bank to bank. In the 8th mile, a swamp; drain 10 feet by 5 feet required. Then some rising ground. All sal jungle. Good medium soil, classed as No. 2 by the Revenue Surveyors.

10 miles, 6 furlongs. Turi nullah, 90 feet wide 12 feet deep. Sandy bed; low, soft banks, flooded; no rock. Then cross a swamp 400 yards wide.

11 miles. Pāparhandi.—About 100 houses and 400 people. Fine tope for camping; good water from Turi nullah. Magnificent old banyan trees, with far-spreading branches supported by numerous root pillars. An old fort overgrown with jungle. A fine temple of Siva, built of stone resembling Chunār sandstone. A fair is held here weekly. There are some sugar-mills at work. The Sub-Magistrate of Nārangpur came here to meet the party.

Mean reading of aneroid battery 28.21.

Height above mean sea level 1,922 feet.

Fall from Dabgaon 61 feet.

Distance of Pāparhandi from Raipur 177 miles, 3 furlongs.

February 5th. Pāparhandi to Nārangpur. Distance 8 miles, 193 yards. Thermometer 6 A.M., 52°; 11 A.M., 72°; 4 P.M., 78°. From Pāparhandi I detached a small party this morning to go up the valley of the Indrabati, and then up the Golagad river to Maribata, to ascertain by the aneroid the height of the saddle between the sources of the Golagad and Ryaguddah rivers; as this valley would seem to offer a favorable line for connecting Ryaguddah with Pāparhandi and for ascending the Jeypur plateau from the former place by an easy ghāt.

The long-promised Revenue Subordinate, in the person of N. Pāni Grāhi, Head Clerk, Special Assistant Agent's Office, Kuraputi, joined the party here at last.

The track leads through fine tree jungle, and then crosses a swamp, where a masonry drain 10 feet by 5 feet is required. After that the ground rises slightly and the soil becomes red. 1 mile, 4 furlongs, another swamp; drain 10 feet by 5 feet required. Another stretch of jungle on rising ground, and then a swamp again. Then a long gentle rise, and descent to swamp. 2 miles, 6 furlongs, a long winding swamp cultivated. Scrub jungle all round.

3rd mile. *Gantat River*, 60 feet by 14 feet; soft bed and banks. In the 4th mile a swamp, with rising ground and jungle on both sides; a similar one in the 5th, and another in the 6th mile.

7th mile. *Village of Majigara*, with a good mango tope. Some laterite. From here a fine avenue, consisting of a treble row of mango trees, about fifty years old, leads to Nārāngpur.

8 miles, 193 yards. *Nārāngpur*, with a Sub-Magistrate's Court, a Mulki Post Office, and a Police Station; the Jeypur Rajah's Amin also lives here, who politely came out on an elephant some miles to meet me. Nārāngpur contains some 650 houses, with from 3,000 to 4,000 inhabitants. It has four tanks and some fine topes. There are carpenters, blacksmiths, and weavers here. Tassar silk is made, also lacqueredware and glass bangles.

The mean aneroid reading is 28°24.

Height above mean sea level 1,918 feet.

Fall from Pāparhandi 4 feet.

Distance of Nārāngpur from Raipur via Rajim and Hāthgāon 185 miles, 4 furlongs.

The Jeypur Rajah's Dewan at Nārāngpur was very obliging, and afforded all necessary assistance to the party.

NARĀNGPUR,
10th February 1882.

(Signed) K. F. NORDMANN,
Executive Engineer, on Special Duty.

NOTE.—The heights, which had been originally only approximately calculated, i.e., without reference to the aneroid readings at the sea-coast, have now been corrected by means of the latter, and are correct.—K.F.N.

XV.

B.

EXTRACT from Executive Engineer's Notes of Reconnaissance from Nārāngpur to Kuraputi via Boriguma and the old Madeoputi Ghāt, 38 miles. February 13th to 16th, 1882.

February 13th. *Nārāngpur to Porli*.—Distance 8 miles, 5 furlongs. Thermometer 6 A.M., 61°; 11 A.M., 83°; 4 P.M., 85°.—After passing southwards through the town of Nārāngpur, extensive rice-fields were crossed; then

Height of Nārāngpur above M.S.L. 1,918 feet.

some jungle, consisting chiefly of mango trees; then another expanse of paddy flats.

In the 1st mile is *Barabukli*, a small village.

At 1 mile, 4 furlongs, a *nullah*, 25 feet by 8 feet, with muddy banks and bed. The prevailing soil is reddish loam, and there is some laterite showing above the surface. At 1 mile, 5 furlongs, the northern bank of the *Indrabati* is reached; the bank is soft and steep, the bed sandy. There was from 2 to 3 feet of water in the river, which has a lively current. The water to be crossed was 220 feet wide, while the river in flood is 465 feet wide and 24 feet deep in the deepest part; the highest floods, which overtop the banks, are said to add 4 feet more to that depth. A ferry is here, consisting of a platform resting on three canoes. Then follows some light jungle with patches of dry cultivation, Bengal-gram, dholl, tobacco, &c.; then more rice-fields. Soil sandy loam. A *nullah*, 10 feet by 6 feet; then paddy-fields. The soil on the higher ground is brown clay.

In the 3rd mile jungle again; the ground rises; prevailing soil laterite gravel.

At 3 miles, 5 furlongs, the summit of the rising ground is reached; after that there is a gentle slope down to a rice flat at the 4th mile. From here the ground continues level for some distance; another swamp is crossed at 4 miles, 6 furlongs; then comes a short rise; the jungle continues.

At 5 miles, 3 furlongs, we are again on a summit, about 50 feet above the last swamp. The jungle here consists of small scrub; soil red gravel. At the 6th mile a small water-course, 7 feet by 3 feet, is crossed. Then a descent to a narrow swamp, and rising ground again on the other side; jungle continues.

At 6 miles, 6 furlongs, the track once more reaches a summit, this time on the shoulder of a small hill. The soil here is brown clay, the jungle light. Then begins a descent. Near the 8th mile the track crosses a paddy flat.

At 8 miles, 5 furlongs, the village of *Porli* is reached, containing about 30 houses and 120 people. Paddy and several kinds of gram, besides garden produce, are cultivated here. There is a good encamping site, well shaded, on the high ground north of the swamp adjoining the village; but the drinking water is of indifferent quality.

Mean reading of aneroid battery at Porli 28°18.

Height above M.S.L. 1,873 feet.

Fall from Nārāngpur 45 feet.

Distance of Porli from Raipur 194 miles, 2 furlongs.

February 14th. *Porli to Pupogāon*. Distance 8 miles, 6 furlongs. Thermometer 6 A.M., 62°; 11 A.M., 84°; 4 P.M., 87°.—Marched over a cultivated swamp, through which a stream flows, 30 feet by 10 feet, with steep soft banks; then over rising ground, after which jungle and swamp occur alternately. The soil on the higher grounds is sandy loam; in the swamps stiff, dark clay.

In the 2nd mile some undulating ground; a long glade to the left, extending north and south, and indicating the direction of the future railway.

2 miles, 2 furlongs. *Village of Kondra*, with a fine mango tope and wet fields.

3 miles, 1 furlong. *Jilimili*, with a tope.

4th mile. *Boriguma*, with upwards of 100 houses; a travellers' bungalow built of mud walls, with a thatched roof. There is a temple with some old tanks about a mile west of Boriguma near Gondaguda. The temple is dedicated to Pātālesworo (Siva), and contains some very ancient carvings, amongst them a figure of Bhoirawan, the husband of Kālī. It is said that a large town stood here in remote times.

4 miles, 6 furlongs. *Village of Duloguda*.—Beyond, swamp and jungle. Soil heavy clay. Then a small ascent, followed by a fall of the ground, and a narrow swamp.

At 5 miles, 6 furlongs, the foot of another gentle ascent; then some undulating ground.

7 miles, 1 furlong; on the summit of the sloping ground, near *Satrela* village; a tope. Then down to a swamp, and up-rising ground again beyond. This is the general character of the country about here: low ridges with easy slopes clad with jungle and forest, alternating with swampy flats partly cultivated.

8 miles, 6 furlongs. *Pupogāon*, a middle-sized village. There is much quartz about here. Fine encamping ground on a high site west of the road, but the water obtained from the tanks is indifferent. Wells could easily be dug in the lower ground, where the water is not far below the surface.

Mean reading of aneroid battery 28°09.

Height above M.S.L. 1,981 feet.

Rise from Porli 108 feet.

Distance of Pupogāon from Raipur 203 miles.

February 15th. *Pupogāon to Rānigar*. Distance 7 miles. Thermometer 6 A.M., 65°; 11 A.M., 80°; 4 P.M., 86°.—The road leads through light jungle, over stiff brown clay; ground slightly rising.

At 1 mile, the summit of the ascent is reached, about 40 feet above the starting point. There are patches of dry cultivation, chiefly red and black gram, in the jungle. Then comes a downward slope, and at the foot of it a small swamp converted into fields. Thence rise again.

In the 2nd mile is the village of *Kundruput*, with some wet and dry fields, and many *mbowa* trees around. The *kenda* tree (*Telegu*, *tumica*) is found here, on the fruit of which mixed with honey and a kind of white clay the poorer *Ooriya* people live to a great extent in the hot weather when they have nothing else to eat.

Further on the village of *Kebbody*; with gardens containing dholl, the castor plant, cholam, tobacco, brinjals, plantains, &c.

From here the road descends to the *Telingiri River* at 2 miles, 6 furlongs. The water at present is from a foot to 18 inches in depth and 90 feet wide, but during floods it is 160 feet wide and 12 feet deep. The banks are of soft clay, alternately high and low; the bed is sandy, but firm.

Near this is *Chept-amb*, an old village-site, where a weekly fair is held, although there is no village now.

South of the river are rice-fields on high sloping ground, not irrigated except by the rain-fall direct. *Mhova* trees abound in this part.

At 4 miles, 3 furlongs; *Bōripūt*, with some date palms and fields of gram, dholl, ragi, paddy, wheat and flax.

Iron is made at *Nawa Bōripūt*, not far from here; but no limestone has yet been found. Soil, dark brown clay. Hills on both sides of the road.

Traffic.—In two hours this morning I met upwards of a thousand pack bullocks, some carrying salt from *Sālūr* to *Chattisgarh*; others rice, wheat, and Bengal-gram from the latter to the former place; again, others going empty to *Kotpad* to buy rice there and sell it at *Sālūr*. One gang was returning empty via *Kankér* to *Raipur*; they had been engaged in taking rice from *Kotpad* to *Sālūr*.

The ground now becomes irregular and in parts rocky; the road is out out of the hill-side; and I saw coolies at road repairs, the first thing of the kind since leaving *Raipur*.

At 6 miles, 1 furlong, a *nullah*, 15 feet by 6 feet, is crossed, which flows into the *Telingiri River*. There is hilly jungle all around.

At 7 miles; *Rānigar*, a small village of five or six huts, on the high northern bank of the *Telingiri River*. Soil red clay.

cultivation up to the village of Roodree, 2 miles, 115 yards from Dhamtari. After passing this village entered jungle with patches of cultivation here and there; the track here runs along the left bank of the Mahanadi, past the villages of Murradeo (3 miles, 5 furlongs, 70 yards) and Gangrel (5 miles, 4 furlongs, 120 yards), crossing this river at 6 miles, 3 furlongs, 57 yards, and reaching the village of Kokri at 7 miles, 2 furlongs, from Dhamtari. Near this village there is a large quantity of stratified gneiss rock cropping out, suitable for building purposes. The track continues up the valley of the Mahanadi (on the right bank) up to 8 miles, 4 furlongs, 68 yards, where it turns up the valley of the Dorki Naddi, which it crosses at 10 miles, 4 furlongs. The valley is about 2 miles in width, with an almost level cross section; on each side there is a low ridge of hills thickly wooded with good trees, principally ippa and matti, and a few teak trees.

At 11 miles, 1 furlong, 55 yards, passed the village of Lankemi, round which there is a large area of cultivated land; soil sandy.

At 12 miles, 4 furlongs, 180 yards, reached camp at Dargahan, where there is a police station-house. There are several good camping grounds near the village, and good drinking water is procurable from a well; distance from Raipur 52 miles, 2 furlongs, 98 yards.

Dargahan, 22nd January 1882. Distance from Raipur 52 miles, 2 furlongs, 98 yards.—Left camp at Dargahan through wet cultivation until reaching the village of Sunghola at 7 furlongs distance. This village is situated on rocky ground, and has a good tank below it; there is some garden cultivation near the village, principally tobacco and castor-oil trees.

At 1 mile, 4 furlongs, 58 yards, reached the village of Bhirawan, a small hamlet at the foot of some hills.

At 2 miles, 4 furlongs, 140 yards, passed the village of Mogragahan, round which there is a large area of wet cultivation and numbers of ippa trees. There is some sugarcane cultivation in the valley of a small stream crossed at 3 miles, 3 furlongs, 100 yards, and a sugarcane-mill at work; the ground is swampy at this place.

At 4 miles, entered the Kanker State near the village of Alva, which is fenced all round as a protection against wild animals. There is a little cultivation near the village in low-lying ground.

At 6 miles, 3 furlongs, 80 yards, entered light jungle, with plenty of good-sized ippa and matti trees; quartz and gneiss rock cropping up in all directions.

Reached the village of Charima on high ground at 7 miles, 5 furlongs, 80 yards, after crossing two streams; there is a little cultivation near the village, which stands in the midst of jungle; kunkur limestone is found near the village.

Reached camp near the village of Polawai at 10 miles, 2 furlongs, 84 yards; near the village is a large tank of fairly good water and a good camping ground; soil all along sandy red clay. Distance from Raipur 62 miles, 4 furlongs, 182 yards.

Polawai, 23rd January 1882. Distance from Raipur 62 miles, 4 furlongs, 182 yards.—Left camp at Polawai at 6-15 A.M. and passed through uncultivated country and some swampy land, reaching the village of Sawada at 7 furlongs and 186 yards. There are numbers of young mango trees planted near the village, and there is about 1 square mile of wet cultivation.

At 1 mile, 4 furlongs, 70 yards, crossed a stream (40 feet by 7 feet) with clayey bed and benches; there is wet cultivation from this up to the village of Kurna, which is a collection of miserable mud hovels. Distance from Polawai 2 miles, 150 yards.

Reached the Mahanadi at 2 miles, 3 furlongs, 125 yards; there is no rock visible in the sandy bed of the river; the banks are clay and well defined. From this the country is uncultivated; ippa trees very plentiful.

Crossed the Makree River at 7 miles, 60 yards (150 feet by 12 feet); bed sandy, and well-defined banks of clay; passed the village of Berawai at 7 miles, 2 furlongs, 190 yards, where there is some little cultivation.

Reached the town of Kanker at 9 miles, 7 furlongs, and crossed the Duhd River at 10 miles, 1 furlong; bed sandy, and banks of clay, well defined (115 feet by 8 feet); passed the Rajah's house and a temple on the west, and encamped beyond the town. Distance from Polawai 10 miles, 7 furlongs. Total distance from Raipur 73 miles, 4 furlongs.

The Rajah's house and the temple, which stand at the foot of a rocky hill, are built with brick in chunam; kunkur limestone is found here, but little or no labor is to be had, there being only two bricklayers, two smiths, and one carpenter in the town.

The chief produce of the country is rice; ragi, green-gram, horse-gram, Bangal-gram, black-gram, and dholl are also cultivated, and a very poor kind of plantain, as well as the usual country vegetables.

Kanker, 25th January 1882. Distance from Raipur 73 miles, 4 furlongs.—Left camp at Kanker at 6 A.M. through small jungle with thick undergrowth; this continued up to 2 miles, 7 furlongs, where the Hatkul River was crossed (167 feet by 15 feet); sandy bed and well-defined banks of clay. Observed much kunkur limestone near the crossing; beyond the river the ground is somewhat broken, and further on slightly undulating.

At 3 miles, 6 furlongs, crossed a smaller stream (40 feet by 9 feet) with sandy bed and well-defined banks of clay.

At 4 miles, 210 yards, reached the village of Kongera, a small cluster of miserable huts, and with about 6 acres of cultivated land near. There is a small area of garden-cultivation consisting of tobacco and castor-oil trees.

Continued through dense jungle up to 5 miles, 6 furlongs, where the Amordorgi River was crossed (40 feet by 10 feet); the banks of this stream above the crossing are well defined, the bed is sandy.

Traversed jungle till the village of Aravali was reached at 7 miles, 4 furlongs, 210 yards. There is a large area of sugarcane, tobacco, and plantain cultivation in the gardens, as also castor-oil trees; the clearing near the village is extensive. No sal trees were met with up to this, but beyond, this was almost the only description seen.

At 8 miles, 2 furlongs, 174 yards, crossed the Hatkul River again (117 feet by 14 feet); higher up the stream the bed and banks are rocky and the cross section somewhat less. The bed is sandy at the crossing, and one bank rocky, the other clay.

Crossed a small stream (10 feet by 6 feet) with rocky bed, and reached camp in a small clearing in the forest at 9 miles, 4 furlongs, 135 yards. There is an abundance of good timber here, chiefly sal. There is no good camping ground, but good water is obtainable from the Hatkul River, 1 furlong distant. Distance from Raipur 83 miles, 147 yards.

Camp in the forest near Salabat, 26th January 1882. Distance from Raipur 83 miles, 147 yards.—Started from camp at 6 A.M. to the Hatkul River, distance 1 furlong, 100 yards; passed up the valley in the bed of the stream, for 1 mile, then up the right bank to Chiprail; 2 miles from camp.

Aneroid reading 28-80.

Continued up the course of the stream, sometimes on the right bank and sometimes on the left, and latterly through dense bamboo jungle, through which the sun could only be seen at intervals, to 7 miles, 2 furlongs, at the junction of two large streams; passed some very large

Aneroid reading 28-67.

sized matti trees in the forest and also sal; from this place the guides desired to take me across to Chiklidi, but I decided to continue up the bed of the stream until I should reach the plateau, and proceeded accordingly. Up to this no obstacles were met with to hinder the construction of a first-class road or railway, the cross section of the ground being almost level. Here, however, some difficulties were encountered; the banks of the stream were precipitous; above, the hills came sloping down at an angle of 45°, and the jungle was impenetrable. I had therefore to move up the bed of the stream, frequently crawling over the rocks, which were as slippery as glass, on my hands and knees; the perambulator could not run over such rocks, and was therefore carried for about 2 miles, which occupied two hours to get over. There is much quartz rock in the bed of the river of a pink color, and gneiss of various colors, black or nearly so, slate colored, and reddish; this last being studded with crude garnets.

At 9 miles (about) the junction of the small stream from Siduwan was reached, and a small path found, along which the perambulator was again started; and leaving the river bed, passed

Aneroid reading 28-40.

through sal jungle for 2 miles, 2 furlongs, 110 yards, when Siduwan was reached. This is a fairly large village, surrounded by a substantial fence of strong stakes, about 6 feet in height; the camping ground

Aneroid reading 28-14.

there is a large clearing, and extensive wet cultivation near the village; the camping ground is not good, there being no shade; and good water is not procurable.

Total distance from Raipur 94 miles, 3 furlongs, (about).

Siduwan, 27th January 1882. Distance from Raipur 94 miles, 3 furlongs (about).—Left camp at 6 A.M. through dense sal jungle, with few trees of any size; thick undergrowth of date shrubs about 3 feet high.

At 2 miles, 4 furlongs, 82 yards, crossed a stream (30 feet by 7 feet) with well-defined banks of clay and sandy bed, and reached the village of Korgaon at 2 miles, 7 furlongs, 104 yards. There is a tolerably large clearing round the village; a small area of wet and some garden cultivation; soil sandy brown clay.

At 5 miles, 130 yards, reached the village of Kalgaon through sal jungle. There are large boulders of gneiss near the village; continued through sal jungle to the village of Kajran, where there is a large area of wet and garden cultivation: tobacco, plantains and some country vegetables.

Crossed the Baordhig River at 10 miles, 210 yards; bed sandy, banks clay, and well defined.

Crossed another stream at 10 miles, 5 furlongs, 90 yards, and reached the village of Liagaon at 11 miles, 3 furlongs. This is the largest village passed since entering the Bustar State. There are a number of carts lying about the village. The area under wet cultivation is large, and there are several small gardens.

Crossed a large stream at 12 miles, 5 furlongs (82 feet by 18 feet) with sandy bed and well-defined banks of clay, and reached camp at Banskot, after crossing a swamp near the village, at 11-30 A.M.; distance 14 miles, 3 furlongs.

Banskot is a small village in a clearing in the jungle, and has but a small area of wet cultivation in the swamp close by.

Banskot, 28th January 1882. Distance from Raipur 108 miles, 6 furlongs.—Left camp at Banskot at 6 A.M. passing through sal jungle with small date shrub undergrowth.

Crossed swampy ground under paddy cultivation and entered the village of Dodra at 2 miles, 4 furlongs, 136 yards; a small village in a small clearing in the jungle.

At 4 miles, 2 furlongs, 110 yards, reached the village of Simora, a small village in a clearing in the jungle with some wet cultivation near.

Crossed a stream (22 feet $\times$ 12 feet) with well-defined banks of clay and sandy bed, and passed through the village of Tumda, the largest village passed this day. There is an extensive area of wet cultivation; and sugarcane, castor-oil trees, and plantains in gardens; two iron-smelting furnaces at work in the village. Passed the small village of Kudi at 7 miles, 1 furlong, in a small clearing in the jungle; and passing through some jungle entered a fine sal forest at 9 miles, 2 furlongs; this continued for about one mile; numbers of trees measuring 14 feet in girth, 4 feet above the ground. Reached camp at Paorbel, a small village in a clearing in the jungle; camping ground not good, and good water not procurable; distance 11 miles, 160 yards.

Paorbel, 29th January 1882. Distance from Raipur 110 miles, 6 furlongs, 207 yards.—Left Paorbel at 6 A.M. through dense sal jungle with but few trees of any size.

At 1 mile, 1 furlong, 180 yards, passed through a small village, also called Paorbel, where there is a splendid camping ground, fine mango and fig trees, giving grateful shade. There is some garden cultivation, plantains, castor-oil trees, and cholam near the village.

Again entered sal jungle and crossed a stream (20 feet by 7 feet) with sandy bed and clay banks at 2 miles, continued through sal jungle up to the village of Odepar at 3 miles, 6 furlongs, 200 yards; some garden cultivation, consisting of tobacco, plantains, castor-oil trees, and cholam; some wet cultivation in low swampy land near the village.

After crossing this swamp, again passed through sal jungle to the village of Mohundi at 6 miles; another small village of the same name lies 2 furlongs further on; a stream with rocky bed and well-defined banks of clay flowing between the two. In the latter village there is an iron-smelting furnace at work, and near each there is some wet cultivation; tobacco, cholam, castor-oil trees, and plantains are largely cultivated in gardens. Passed through sal jungle until reaching camp at Gurjunga at 9 miles, 6 furlongs, 180 yards from Paorbel. This is a small village in a clearing in the jungle surrounded by a fence of stakes; part of the enclosure is under tobacco, cholam, plantains, and castor-oil tree cultivation; camping ground not good, and water abominable.

Gurjunga, 30th January 1882. Distance from Raipur 129 miles, 5 furlongs, 167 yards.—Left camp at 6 A.M. through sal jungle, passing through a belt of good forest. Many trees (sal) measuring 11 feet in girth, 4 feet above the ground; soil sandy red clay.

At 1 mile, 5 furlongs, 100 yards, crossed a stream (18 feet by 8 feet) with sandy bed and well-defined banks of clay; and a second stream at 2 miles, 2 furlongs, with rocky (gneiss) bed and banks at the crossing, and for some distance up stream (58 feet by 9 feet).

At 3 miles, 2 furlongs, crossed a third stream (40 feet by 8 feet), and at 4 miles, 2 furlongs, 160 yards, a fourth stream (20 feet by 8 feet), both streams having rocky beds and banks. Reached the village of Kurulubahal at 5 miles, 4 furlongs; here there is an excellent camping ground, a large clearing, and good shade from mango and fig trees. There are also some fine ippa trees here, and good water is procurable; an extensive area is under wet cultivation just outside the village; some garden cultivation also; soil quartz gravel.

At 6 miles, 6 furlongs, 145 yards, passed the small village of Serapur in a small clearing in the jungle. Proceeded through alternate belts of sal jungle, and abandoned clearings covered with grass 5 and 6 feet high, to the village of Bakuda; distance 11 miles, 6 furlongs, 200 yards. Camping ground not good; no shade; good water is procurable.

Bakuda, 31st January 1882. Distance from Raipur 141 miles, 4 furlongs, 147 yards.—Left camp at Bakuda at 6 A.M. through sal jungle. Crossed the Damabal River at 5 furlongs, 100 yards (90 feet by 12 feet), with sandy bed and well-defined banks of clay; after passing through a belt of sal forest crossed the Patibal River at 2 miles, 1 furlong (68 feet by 10 feet); the bed and banks of the river are rocky. After passing a very large area, recently under wet cultivation, entered the village of Bāmini at 3 miles, 6 furlongs, 110 yards; here there is an excellent camping ground in a fine large mango tope, and good shade. There are several good gardens with castor-oil trees, plantains, and tobacco cultivation.

At 4 miles, 7 furlongs, crossed a stream (18 feet by 9 feet) with sandy bed and well-defined banks of clay; there is much rock above the crossing.

At 5 miles, reached the village of Barhona a small village in a clearing, castor-oil and plantain trees in gardens, and fine mango and tamarind trees outside the village.

Crossed a stream at 5 miles, 7 furlongs, (18 feet by 12 feet), with sandy bed and clay banks, and reached the village of Bironi at 6 miles, 2 furlongs, 130 yards; here there are gardens with sugarcane, plantains, castor-oil trees and tobacco, and a large area of wet cultivation. There are some fine mango and tamarind trees south of the village, and good water is procurable from the stream.

At 7 miles, 4 furlongs, 100 yards, passed the village of Koeltiamo, where there is a tank and an irrigation channel about a quarter of a mile long; the village is small, but there is a large area under wet cultivation.

At 8 miles, 7 furlongs, reached camp at Omorkot, a large village with a large area of wet and dry cultivation; tobacco, castor-oil trees, and plantains in gardens, and several descriptions of country vegetables. There is a police station-house here and a force of 18 Police Constables and 1 Head Constable. The camping ground is in a fine tope, where there is good shade; good water is procurable from the river at hand.

Total distance from Raipur 150 miles, 3 furlongs, 202 yards.

OMORKOT,
1st February 1882.

(Signed) J. CORMAC,
Sub-Engineer.

XVII.

D.

MR. CORMAC'S DIARY OF RECONNAISSANCE FROM PUPOGAON VIA JEYPUR TO KURAPUTI, 15th and 16th February 1882. Distance 24 miles.

15th February 1882. Pupogaon, 1,981 feet above M.S.L.—Left camp at 6 A.M. over waste land, passing the village of Pupogaon at 3 furlongs, 160 yards, where there is a tank of good drinking water and a large number of fine mango and tamarind trees giving good shade. After leaving the village, passed through a considerable area of swampy paddy-fields, and crossed a stream (30 feet by 8 feet) with muddy bed and clay banks which are not well defined.

At 1 mile, 6 furlongs, 184 yards, passed the village of Dangragoon, a small cluster of wretched huts with a small area of paddy-fields.

At 3 miles, 1 furlong, passed the village of Dondasanogoda on the left; on right sal jungle with jack and ippa trees; soil sandy; a large area of rice-fields just beyond the village.

At 4 miles, 2 furlongs, 200 yards, crossed a stream (40 feet by 11 feet) with well-defined banks and muddy bed, and then through paddy-fields to the village of Randapali, which was passed at 4 miles, 7 furlongs, 94 yards. There are only 10 houses in the village, which has a tank of good drinking water and several fine topes of mango and tamarind trees.

At 6 miles, 2 furlongs, crossed the Potra stream (120 feet by 14 feet) with well-defined clay banks and sandy bed; a fine tope of mango trees on the left bank; on each side of the stream there is a wide area of rice-fields.

At 7 miles, reached the village of Umerigaon with 60 houses and several fine mango topes; a blacksmith was at work in a small shed making knives. At this village I was met by the Dewan of the Maharajah of Jeypur. Here I joined the road from Boriguma to Jeypur. Crossed a stream in swampy ground (18 feet by 8 feet) and, passing over rising ground uncultivated, crossed a second stream (12 feet by 8 feet); small scrub jungle to the right and paddy-fields to left. In the swampy places the road is in embankment about 2 feet high; the streams are not bridged. Crossed high ground, along the road, and then turned eastward along a roughly-made narrow road, crossing several small streams leading into a large tank covering an area of upwards of half a square mile; tank on the right, and a halting bungalow on the left; then through a fine mango tope, and past a second large tank, to the camping ground in a mango tope, outside the town of Jeypur. Distance traversed 10 miles, 4 furlongs. There is a good bungalow here for travellers, and good drinking water; there are large topes of fine mango trees covering a very large area, and giving good shade, which make excellent camping grounds. There are about 2,500 houses in the town and 8,000 inhabitants; about 20 houses are tiled and one terraced, the remainder being thatched.

The Maharajah of Jeypur resides in the town; a palace of brick and stone is now being constructed in the enclosure, which contains a number of small dirty buildings, and the Maharajah's present residence and offices. There are a Sub-Magistrate, an Inspector of Police, and 15 Constables in the town; there is an Elementary School maintained by the Maharajah.

The produce of the taluk consists of rice (sold at 30 seers per rupee in Jeypur), ragi, green-gram, dholl, Bengal-gram, wheat (in the Kotpad Taluk), and linseed. Sal, jack, ippa, tamarind, matti and mango trees (especially the latter) are abundant. There are some silk-weavers in the town, who procure the cocoons of the tassar-worm from Kotpad. About thirty goldsmiths, thirty carpenters, and ten smiths reside in the town; but no bricklayers, these being brought up from Sālūr when required; stone-cutters are obtained from the Ganjam District. Kunkur limestone is obtained from Jagannathapuram, a village about 3 miles distant from Jeypur. The town lies in a hollow, near the foot of the hills; the site does not seem a healthy one. The unhealthy season is in July and August, after the commencement of the rains.

The adjacent hills are gneiss; laterite is also found in abundance.

16th February 1882. Jeypur, 1,955 feet above M.S.L.—Left camp at 6 A.M. through mango topes, and joined the road from Jeypur to Kuraputi at 5 furlongs. Travelled along the road from this place, with small scrub jungle on both sides (ground side-lying and rocky), crossing some small streams, to 2 miles, when a large stream (63 feet by 14 feet) with rocky bed and well-defined banks was crossed. This spot is only 24 feet higher than the starting point of this day's march, and up to 2 miles, 4 furlongs, 70 yards, the rise is inconsiderable; from here, however, to 3 miles, 2 furlongs, 160 yards, there is a rise of 345 feet, the gradient being 1 in 12; in the next half mile there is a descent of 84 feet; then a continuous rise to 5 miles, 1 furlong, of 622 feet, the gradient being 1 in 11½; a fall of 84 feet follows in the next half mile, and then an ascent by a gradient of 1 in 40 to 6 miles, 3 furlongs, 160 yards.

The village of Bogepodor, which was passed here, lies some distance away to the right. Crossed undulating and hilly country, with some good timber trees about, and a small area of sal jungle about a mile distant. The country is cleared of jungle up to the village of Damiguda at 11 miles, 2 furlongs, 110 yards; this is a small village of about 20 houses, with a small area of cultivated land near; a stream lies between the village and the road.

At 12 miles, reached the saddle overlooking Kuraputi (height 2,999 feet) and descended to the town of Kuraputi at a gradient of 1 in 12; passing through the station along the road, reached camp near the quarters of the Special Assistant Agent at 13 miles, 3 furlongs.

KURAPUTI,
19th February 1882.

(Signed) J. CORMAC,
Sub-Engineer.

XVIII

E.

From Sub-Conductor J. CORMAC, Sub-Engineer, to K. F. NORDMANN, Esq., Executive Engineer, on Special Duty, dated Omorkót, 1st February 1882, No. I-O.

I beg to inform you that, in obedience to your orders, I left Raipur on the 18th ultimo for Omorkót via Dhamtari and Kankér.

2. The road from Raipur to Dhamtari is gravelled for about half a mile outside Raipur, after which there is simply a cart track, without any surface covering; it has been so worn by traffic that in some places the level is lower than that of the adjacent fields; avenue trees have been planted all along, but are not now in a very healthy condition; mangosa trees, which give little or no shade, compose the avenue for quite 15 miles.

3. The line is bridged for the first 10 miles, and for this distance the soil is generally sandy; beyond it is black cotton soil, full of holes and fissures; and during the rains the road will be almost, if not quite, impracticable for carts.

4. No large streams are crossed between Raipur and Dhamtari, and the country is almost level; it is dotted over at present with large stacks of rice straw, which testify to the abundance of the crop recently cut.

5. The grains chiefly cultivated are rice, wheat, linseed, Bengal-grain, green-grain, and ragi; rice is now being sold at Dhamtari at 55 seers and wheat at 40 seers per rupee.

6. The chief exports are rice, wheat, linseed and lac. I met sixteen carts leaving Dhamtari laden with the latter, and passed forty-one carts going there for loads of the same; this lac is the product of an insect, the *Coccus lacis*, which deposits its eggs upon certain trees, and covers them with a reddish resinous substance which is lac, and intended as a protection to the eggs.

7. Some native cotton cloths are manufactured at Dhamtari and tassar-silk cloths at a village 20 miles distant; the tassar silk worm being found in all the sal jungles in this part, feeding upon the leaves of the sal and the matti.

8. There is no systematic irrigation, the crops being dependent on the seasonable fall of rain; there are numerous tanks kept in admirable repair by the ryots at their own expense; these are, however, generally used for drinking purposes, and are not situated so as to be of much use for irrigation.

9. The soil is very fertile, and the country passed through is cultivated to the fullest possible extent; there are but few small patches of uncultivated land to be seen.

10. There are good tops of fine mango trees near the villages, but no other timber was seen except a few unhealthy-looking acacias, dotted over the country near Dhamtari; firewood is scarce and dear.

11. Dhamtari was reached on the 19th ultimo. The town has a population of about 14,000 inhabitants and about 5,000 houses, chiefly mud huts; there is a Tahsildar's Cutcherry, Post Office, Police Station-house, and Hospital in the town, which is surrounded with magnificent tops of mango and tamarind trees; there are several fine tanks near the town.

12. Limestone is procurable near Dhamtari, and a fair supply of labor; cooly-hire being one and-a-half annas per day for men; and for such bricklayers, carpenters and smiths as are to be had there, from three to five annas per day.

13. Leaving Dhamtari on the 21st ultimo I crossed the Mahanadi River twice and the Makri and Dahd Rivers, reaching Kankér on the 23rd; the latter river divides the town of Kankér into two portions.

14. There is a good and easy cart track all the way from Dhamtari to Kankér; and as the soil is more sandy, the line will not be so difficult in the wet weather as between Dhamtari and Raipur.

15. The country between Dhamtari and Kankér is jungly, only one-third (or thereabouts) of the whole area being under cultivation; so, as far as I could learn, the Kankér State produces little more than is required for consumption within its own limits, and the exports are incon-siderable.

16. The grains chiefly cultivated are rice, wheat, green-grain, Bengal-grain, horse-grain, and ragi.

17. Mango and ippa (mhowa) trees abound; the spirit distilled from the flowers of the latter tree is sold in the villages at one anna per quart; a few teak trees were also met with, but none of any size.

18. The hills, which run almost parallel with the track for about 14 miles from Dhamtari, are well wooded, chiefly with ippa, matti, and bora trees; a deal of care is given to the planting of mango trees, several tops of young trees having been passed on the way.

19. The villages in the Kankér State are small, and, generally speaking, composed of miserable mud hovels; the town of Kankér is a little better in this way, the huts being somewhat larger, and possessing a temple and house belonging to the Rajah, built of brick in chunam; the villages are all fenced in as a protection against wild animals.

20. The camp at Dargahan was twice alarmed in the night by a cheetah, and the foot-prints of one of these animals and of a tiger were observed for a distance of 2 miles along the track traversed; wild buffaloes are said to be numerous here, though none were seen by me.

21. The country near Kankér is hilly, chiefly rocky hills of gneiss with low jungle. Kunkur limestone is found at several places, and was seen near Charima and Kankér. There are two bricklayers, two smiths, and one carpenter in the latter town, their hire being two and-a-half annas per day, cooly-hire one anna per day.

22. I left Kankér on the 25th and passed up the valley of the Hatkul River through dense jungle, with fine matti trees here and there, and thick undergrowth, meeting with sal trees on entering the Bustar State.

23. I camped the same night in the jungle; and having sent on my baggage the next day via the Tel Ghât to Siduwan on the plateau, I started up the valley of the Hatkul River, passing Chiprail, making my way, where the jungle on the banks was impenetrable, in the bed of the stream; there was no path, but the perambulator was run for 7 miles (5 beyond Chiprail) and the barometer showed a rise in this distance of only 130 feet.

24. From this point the perambulator could not travel, and had to be carried; the banks were covered with dense undergrowth, quite impenetrable, and were in some places precipitous; so that I had to make my way up the bed of the stream, climbing at times, on my hands and knees, the rocks being as slippery as ice in several places; about 2 miles were covered in this manner, the aneroid showing a rise in that distance of 270 feet; a path was then found, and the perambulator started along it, measuring 2½ miles to camp with an ascent of 260 feet; this was the highest point reached, and the approximate height above mean sea level was 2,050 feet.

25. From Siduwan the country commenced to fall, and continued to do so until Omorkót was reached.

26. The villages passed are composed, generally speaking, of a few miserable huts, built near water-courses, and fenced round with stout stakes placed closely together, about 6 feet high, inside which is some garden cultivation: tobacco, castor-oil trees, plantains, and the usual native vegetables. The villages are usually about 3 miles apart, with alternate belts of sal forest and abandoned clearings intervening.

27. The area cultivated is certainly not more than one-twentieth of the whole, so that there is ample room for a large number of immigrants; this remark applies to the whole country from Kankér to Omorkót.

28. Good camping grounds were observed at Paorbel, Kurulubahel, Bamini, and Omorkót; near the other villages passed all trees have been cleared, and there is no shade. The water-supply on the plateau is not good; and as there are no means of storage, there must be a scarcity in the dry season.

29. Several belts of fine sal forest were passed through, some trees measuring 11 feet in girth, 4 feet above the ground.

30. The soil in the hollows and swampy places is black clay, and in the portions at a higher level sandy reddish clay.

31. The country is sparsely populated, and all labor will have to be imported; the clay found everywhere is suitable for bricks; and stratified gneiss, suitable for building purposes, is found in several places; kunkur limestone is found here and there, and will, I believe, be found all over the plateau if searched for; there is an abundance of good sal wood in Bustar and Jeypur.

XIX.

F.

REPORTS by Colonel A. FRANCIS, late Executive Engineer, Raipur Division.

Report on the Road from Raipur to Dhamtari.

The total length of this road from the cantonment boundary is 38 miles.

Soil.—Of these only 8 are moorum, sandy loam or laterite; the remaining 30 are black cotton, very deep; and at least 10 miles of these 30 are under water from 6 to 16 inches deep for from four to five months during the rain, owing to the road being on the same level or a little lower than the rice-fields which are on both sides.

Masonry Works.—The first six miles and a quarter are bridged with seven drains and bridges; the waterway of five of these is too little, and the approaches have been breached.

These breaches have been now sloped down to allow high floods to pass over. It would be an improvement torevet both sides of these slopes with a masonry wall, as then a foot of good broken stone could be rammed between them, and a causeway would be formed that would remain hard even after rain.

Nullahs and Rivers.—Between the last bridge built and the village of Bhukara, a distance of 18 miles, there are ten nullahs, all of good size, from 15 to 60 feet broad, and which have all soft and swampy bottoms; and offer considerable obstruction to traffic up to the end of January, and even when the bottoms become dry and hard, yet from the very steep slopes leading to them they detain heavily laden carts for hours.

Improvements required.—These nullahs should have causeways; and instead of the raised causeways, such as have been built on the Bellaspur and Sumbulpur road, it would be both better and cheaper to build walls, level with the bed of the stream and running up the approaches as far as high-water mark, on the up and down stream sides, and then fill in between them a foot of hard road metal well consolidated.

There is but little scour, and it would stand well; the raised causeways become very slippery and covered with green moss.

From Bhukara to Dhamtari there is only one causeway required, but that one, though not large, will have to be carefully constructed, as it is in one of the submerged lengths; and in the rains the first intimation a traveller has that there is a nullah is finding the water above his saddle flaps. A raised causeway with hand rails above high water level, and with openings for the bottom water to pass through, would probably be the best for this. All the approaches to these nullahs require being brought to a proper slope, which could easily be done.

The map shows that the Karun River runs with the road on the west side at a distance varying from 1 to 3 miles; the road runs north and south nearly, and the drainage is from east to west.

The country is very flat, and the road running across the drainage has suffered very much from the scouring of its side ditches; in some places they are 8 feet deep.

These side ditches have been dug between the road and avenue, and should be filled and dug outside the avenue, or, better still, omitted altogether, as, owing to the light nature of the soil, the smallest stream of water cuts deeply in a few hours until the harder subsoil is reached.

To convert the present road into a bridged road for all weathers would be very expensive as on an average the whole 30 miles of black soil would have to be embanked about 3 feet to lift it 1 foot above high-water mark.

Eleven streams would have to be bridged, all of which, owing to the proximity of the Karun River, rise and overflow their banks when that river is in flood; besides these eleven bridges numerous small 3-feet drains would be required.

The present state of the road shows how dangerous it is to carry the water from one nullah to another along the sides of the road.

REPORT on the Road from Dhamtari towards Raigarh as far as the boundary of the Central Provinces.

First stage, from Dhamtari to Kukrel, distance 8½ miles.

Starting from the new Tasilee, the main street of Dhamtari is broad for a short distance, it then contracts into a narrow lane, the houses having encroached on it until there is only about 9 feet left; and this in the rains is knee-deep in water. After getting clear of the town there is a mere track to the Achota Ghat; across the Mahanadi River the road requires marking out.

The soil is very sandy and heavy, but there is moorum in the vicinity, and a good road could be made at a small expense. The road could also be made good up to the Tasilee with very little damage to the houses, as by a little care in lining, it would be chiefly compound walls and outhouses that would be taken down.

The distance from the town to the river is 2½ miles. The banks of the river require but little sloping; the north bank especially is easy; the south requires a little done to make an easy slope. A memorandum of probable expense will be given at the end, as more easily noted than if scattered through the report.

After crossing the river the cart track is well defined; the soil is sandy for the first half mile; jungle open. The soil then changes to good moorum up to the village of Bhojina, which is 4½ miles from Dhamtari, where the soil becomes a sandy loam, varying from hard to very sandy, and continues with little change to Kukrel.

The two nullahs on the road are easy, with hard bottoms, with stone at hand for causeways, if considered necessary; but unless the traffic increases very considerably, the causeways will not be required.

Water is procured from a nullah which, though indifferent in quality, is sufficient now; later there must be some scarcity.

The Malguzars of this place are Baboojee Huddut and Jinyars; they appear well-to-do, and informed me they held other thirty-four villages; they have an elephant and good ponies, but professed entire ignorance as to the road beyond their own village.

From Kukrel to the village of Bualngowd, about 1½ miles, the track is good and easy; and road as marked on the map, Sheet No. 1 of the Ganjam and Orissa Topographical Survey, runs over rocks and stones; to avoid this the cart track turns to the village of Komda. A glance at the map will show that the line runs along a water-shed; and up to the borders of Bustar near

Burgudee the tracks are well chosen in this respect, avoiding nullahs and cross drainage; and the points passing from one water-shed to another are wonderfully well chosen.

Second stage, from Kukrel to Dokal, distance 10½ miles.

The whole length by the old track is 8 miles to Dokal from Kukrel, but the cart track is a mile and-a-half longer; still it is to be preferred for a fair weather road.

The jungle is of the same description as to Kukrel: tall trees without much girth, only fit for poles, with no underwood. The grass has mostly been burnt. The headman of Dokal is Mithoo Naik, who gave a good deal of information willingly. He is a very intelligent old Brinjarri; he has dug a tank and built a temple, and possesses about one hundred head of cattle.

Third stage, from Dokal to Gatasili, distance 10 miles.

From Dokal there are three tracks, but only No. 1 is good for carts; the second is at present impassable except for foot-passengers and pack animals; the third an empty or lightly laden cart can pass with difficulty. No. 1 goes by Parwari, Donora, Paigaon, and on to Gatasili, a very round-about track, but easy; the extra length is 3 miles.

The second is that shown in Sheets Nos. 1 and 3 of the Ganjam and Orissa Topographical Survey, and the only difficulty is at the crossing of the Silari River. Should this line be taken, and it is the best of the three, a proper crossing must be traced, which is not difficult.

The present crossing is taken straight down the face of the hill on to a low spur, and then, turning on the spur, nearly straight to the river; this point on the spur should be retained, and the slope worked from it upward along the side of the hill where any desired gradient can be worked out; and downwards, first keeping a little way along the side of the hill, till sufficiently low, and then bending round by the left to the river. A trial trace should be first made, 3 feet wide; there will not be much blasting; most of the rock is detached boulders. For approximate expenditure, see memorandum at the end.

The third line leaves Parwari on the left and runs by Attakolee to Gatasili. The crossing of the river is easier than in No. 2, but the nullahs that have to be crossed are a little larger, and it approaches Gatasili from the wrong side of the tank through swampy ground; and, notwithstanding easier crossing and less clearing of jungle required, will not be so satisfactory in the end. The track is here, as elsewhere, generally about 8 feet broad; in places it is much more, even 30 feet, and looks like a road; but this is only for very short distances. Up to Dokal the road may compare favorably with the road from Busna to Buranankera on the Sumbulpur road; and after this crossing is made and jungle cleared, &c., the road on to Gatasili will be equally good. There are in this stage six nullahs to cross, besides several smaller drainage channels; but all have hard bottoms, and can have easy slopes to their banks.

The ground near Parwari looks as if it would be very swampy in the rains and up to November.

Fourth stage, from Gatasili to Burgudee in Bustar Territory, distance 9½ miles.

From Gatasili to Burgudee the road is everywhere passable; where there is jungle the trees are thicker together, but still there is very little valuable timber, and open spaces are more frequent than in the second and third stages. There are four nullahs in this stage; the one nearest Burgudee will be the longest, and it is the only one that has a bad bottom.

The detour taken by the road here is necessary, for on examination of the ground to the right, with a view to cutting off this bend, it proved to be very swampy, and a long and heavy embankment would be necessary; besides the nullah here would have to be bridged, as it is very muddy and holds water to the end of the hot weather. The road crosses the boundary of Bustar near the 9th mile from Gatasili, and the town of Burgudee belongs to Bustar.

The Sihoa road turns just before reaching Burgudee, from which Sihoa is about 4 miles. Several of the villages marked on the map have been deserted. Gatigaon remains; Kongera and Paklupara have disappeared; but a village in these parts means a few huts made of sticks without mud walls, and very imperfectly thatched.

Burgudee is the best-to-do village on the line; gram and other supplies are procurable. There was a difficulty about guides here, and a peon had to be sent down to Belargaon to bring up a guide, the headman of Burgudee steadily refusing to give any guide. When guides had been procured from Belargaon, he then gave one who knew the country well, though for four hours he had declared not a man in the village knew the road to Borai.

Fifth stage, from Burgudee to Borai, distance 19½ miles. From Borai to the boundary, distance 3 miles. Total distance from Dhamtari to boundary 61 miles.

From Burgudee hills are visible on both sides, and also in front; the road here is very undefined; apparently it is cultivated in the rains, and the traffic picks out a path in the dry weather. Up to this point there passed on an average twelve carts and thirty foot-passengers a day and sixty head of pack cattle every other day.

From this point carts cease; only ten pack cattle pass in three days and about fifteen foot passengers. At Keontipara, ½ of a mile from Burgudee, the Mahanadi is crossed; this is also the boundary of Bustar. From this the line is in Kalsa; the road runs by Banka to Belargaon; this latter is a very straggling village. Three nullahs are passed, and the ground will be swampy until late in November. After the road is fairly opened, an embankment will be

needed here and causeways, but the whole of this 3 miles require lining out; probably a better crossing could be found for these nullahs.

The country changes from Belargaon; the hills draw close to the road; the jungle is thicker and the trees are of better size. The track continues fair after passing Belargaon; but 7½ miles from Burgudee the road runs round a very steep hill, marked A on the trace; this is rocky, with a nullah on the right, and will have to be worked out. The whole road from Burgudee should be relined and straightened, the jungle cleared, and nullahs sloped; the general direction cannot be altered on account of the ground.

The road from this point is only a foot-path, though four carts came down with the camp with only one breakage. 12½ miles from Burgudee the Chita River is crossed for the first time; during the day an attempt was made to see if the road could be turned round this river and be brought down the left bank on the line shown by red dots B B B; but the ground is very difficult, and the expense of making even a 12-foot track through it would be great. To ascertain the feasibility properly, a trial trace should be cut; but the natural difficulties (rock and ravines) appear to be too great for a line of road, the traffic on which can never be anything but very small. Crossing the Chita River, the road gets a little better, and the path is more defined; for merely a fair-weather road the fact of crossing the river twice is of little consequence, as the crossings can be made very easy.

Towards the top of the ascent the brushwood commences and becomes thicker as you proceed. Before reaching Borai it is thick; the trees along this portion of the road are larger; several fine tall trees were seen. The jungle becomes more open; after reaching Borai it ceases, fields and low hills replacing it. About 2 miles of jungle have been cleared on this line of road before reaching Borai, but the trees have been cut too high up, and the stumps are rather long and sharp; but still it renders the track easier. From Borai, Baniadi village is visible; and between this and Hathmoli is the boundary dividing the Central Provinces and Jeypur. This line runs through fields, and should be embanked from 1½ to 3 feet high. The nullah is a very troublesome one, and as there is plenty of timber lying and rotting within 3 miles, I would suggest a good substantial well-put-together wooden bridge; the only cost would be the carriage and labor. Care should have to be taken to clear all grass from its vicinity early in November to prevent its being burnt; and a bridge could be put up that would last for twenty years.

From the boundary Raigarh is about 15 miles; from thence to Narangpur is 65 miles; the road is not yet in hand on this section. From Narangpur to Kuraputi there is a dry-weather cart road, distance 36 miles. Pottinghy Ghât is 28 miles from this, and Sâlar 24 miles beyond Pottinghy. This would fix Pottinghy, which is not marked on any of my maps, at about 18° 50' north and 83° 12-30' east. Sâlar is well known; it is 66 miles from Calingapatam, 52 miles from Bimlipatam, and 66 from Vizagapatam; the new ghât commences 4 miles from Sâlar, and is 20 miles in length. The distances given are by the road, not straight across country; the ghât is not expected to be finished till 1878, by which time the rest of the road may probably be somewhat advanced. In looking at the Ganjam and Orissa Topographical Survey it appeared likely that a line from Borai, leaving Hathma to the left, up to Gorawan would probably be easier than the Chita River route; although if this line should be decided on, owing to the swampy nature of the ground near Kaunkera and Mainpar, it will still be advisable to run the road by Borai, joining into the Chita River road on the ground just above the village.

Returning from Borai to Dhamtari the first stage had to be any place where water was to be found, as there are no villages on the line. The spot selected was Birpani, just at the junction of the roads from Hathma and Kosmi to Gorawan. It takes its name from a large bir tree.

First stage, on return from Borai, by Hathma to Birpani, 10½ miles. From Border to Borai, 3 miles. Total 13½ miles.

The first 7 miles are easy; the proper line would be somewhere between the two red-dotted lines, but the jungle is too thick to decide without cutting a trial trace.

The next 4 miles, after crossing the Dhamtari border, present as many difficulties in the way of rock-cutting and clearing as the Chita River route, though only one nullah of any size is crossed up to this point.

There is a thick bamboo jungle for these last 4 miles, with rocky hillocks on both sides of the path; and the line is exactly that shown in the map, with the drainage sometimes from right to left and sometimes from left to right.

Second stage, from Birpani to Borsidonga, 6½ miles.

The nullah is crossed immediately after leaving Birpani, and long slopes with some rock-cutting will be required. Bamboo jungle continues as before up to the place where the road for Amgaon turns off; here it ceases; open jungle commences, the country becomes more and more clear, and the soil changes from good to black cotton. From this point up to Borsidonga will be wet and swampy until January. Any line can be taken here; the carts drive all over the country. From Borsidonga hills are visible on all sides, from 1 to 5 miles distance.

Third stage, from Borsidonga to Jamgaon, 9½ miles.

From Borsidonga up to Deklaond there is no defined road, but carts drive over the country in any direction they wish, making a detour to avoid any difficulty. The ground is usually black, and will be swampy till late; it is quite dry now.

The Mahanadi is crossed near Déokot, and is about 250 feet broad. There is no jungle, only pollard trees. At Deklaond a road joins from Bamka, and from this point there is a well-defined route; the pollard trees continue, and soil changes to hard sandy loam. There are after this about 2 miles of uncultivated jungle, open and with no large trees. Passing this, the trees have again all been lopped; and on to Jamgaon the country continues the same, with here and there short distances of swamp, or what would be swamp in the rains and cold weather.

Fourth stage, from Jamgaon to Madgadaian, 9½ miles.

From Jamgaon the track continues good and well defined; country open; trees are lopped as before; a river about 100 feet broad is crossed, near which is a narrow belt of uncultivated jungle; the soil is black cotton with a few yards of hard kunkur now and then. The small drainage channels would be troublesome if there were any traffic. All the large nullahs have good sandy bottoms and easy slopes. There is a little cultivation at the village of Bansoli; after this there is a mile of very good road, and then three chains of swamp, after which for 3 miles the road is good, running through open jungle; and the soil improves and continues good up to a small drainage channel which has a soft bottom, on the other side of which is black soil until the nullah is reached, on the bank of which is the village of Madgadaian.

Fifth stage, from Madgadaian to Themli, 9 miles.

This march is a difficult one. Carts can go, but nullahs are numerous. The road is shut in with rocky hills, and so confined that one large nullah is crossed four times; six other nullahs are passed, and everywhere the track is sandy and heavy, except where it is rocky. There are about 2½ miles of rocky track on which a good deal of labor would be required to make it easily passable, and the line is one that would not be chosen if there was the slightest possibility of the road being bridged or much improved.

Sixth stage, from Themli to Dhamtari, 8 miles. Total from Border to Dhamtari, 56½ miles.

From Themli the road crosses the Silari River, and is shut in for about 1½ miles between the river and a ridge of rock; the hill then recedes from the river, and the track runs through cultivation and waste to the Mahanadi, which is crossed at Rodree ferry. The track up to this point is very heavy. After crossing the river, there is half a mile of good hard soil, and then alternately sand and swampy ground, to the town of Dhamtari.

Summary.

From the above it will be seen that there are two tracks, one by Kokrel, Dokal, Gátasili, Burgudee and Borai, 61 miles in length, and the other by Themli, Madgadaian, Jamgaon, Bursidonga, Birpani and Borai, 56½ miles.

The first runs, with the exception of 1½ miles, entirely through country belonging to the Raipur District and under the Tasilees of Dhamtari; it is now used by carts as far as Burgudee, offers no great obstacles, and up to this point can be improved, to any extent that may be considered advisable, by a corresponding expenditure. The soil on the whole is favorable, and the only heavy work is that detailed from Burgudee to the boundary, 22½ miles. This road is also linked by a fair cart track to Sihóá from Burgudee; and what cart traffic there is, follows this line.

The second line is through a much more open country, and the soil is generally unfavorable, swampy and heavy; and it would be a good month longer than the first route in becoming dry. The last two stages from Madgadaian to Themli and Dhamtari is also very difficult, and could not be taken for anything but a fair-weather road. The distance is 4½ miles shorter than the first route; but owing to the heaviness of soil, carts would take longer to traverse the shorter distance; it also runs for half its length through Kankér territory, and the Sihóá carts would have to follow the first route as far as Bamka before being able to join into this track.

Under these circumstances the first appeared the best, and a memorandum of expenditure required to open it for a cart track, 15 feet wide, is appended.

DRUG,
18th March 1876.

(Signed) A. FRANCIS, Lieut.-Colonel,
Executive Engineer, Raipur.

XX.

From K. F. NORDMANN, Esq., Executive Engineer, on Special duty, to Colonel R. H. SANKEY, C.B., R.E., Secretary to Government, Public Works Department, Madras, dated Waltair, 30th March 1882, No. 60 W.

SIR,—Adverting to my letter, No. 38-K, dated 25th ultimo, with which I submitted my Report on the Reconnaissance from Raipur to Koraput, I have the honor herewith to forward* the longitudinal sections (specified below) of the routes

* In two registered covers.
traversed, as well as cross sections of streams.

- 14 longitudinal sections of the line from Raipur via Dhamtari, Kankér and Banskót to Omorkót (150 miles).
 - 2 longitudinal sections from Pupagáon via Jeypur to Kuraputi (24 miles).
 - 21 longitudinal sections of the line from Raipur via Rajim, Noagarh, Háthgáon, Omorkót, Nárangpur, Ránigar, Mádeoputi to Kuraputi (218 miles).
 - 27 cross sections of streams, exceeding 30 feet in width, on the route via Rajim, Noagarh, &c.
2. The above sections have been unavoidably delayed, owing to the want of tracing cloth, which has since been received. One set had been prepared at Kuraputi, but was spoilt and had to be done over again.
 3. Revised sections of the line from Ryaguddah via Singapore, the Músa Ghát, Bondesor and Dádpur to Bógur, promised in paragraph 3 of my letter, No. 20-B, dated 4th December 1881, are under preparation and will shortly follow.
 4. The final report, and drawings belonging to the last section of the Reconnaissance, viz., the crossing of the Jeypur plateau and the descent down the Eastern Gháts, are now in hand, and will be submitted from here before I embark for Madras.

XXI.

From K. F. NORDMANN, Esq., Executive Engineer, on Special duty, to the Secretary to Government, Public Works Department, dated Camp Waltair, 14th April 1882, No. 72 W.

As promised in paragraph 3 of my letter, No. 20-B., dated 4th December 1881, and paragraph 3 of my letter, No. 60-W., dated 30th March 1882, I have the honor herewith to submit 11 revised longitudinal sections of 95 miles of country reconnoitred by Mr. Sub-Engineer Cormac, in November last, between Ryaguddah, the Músa Ghát, Bondesor and Bógur.

2. The altitudes have now been corrected, with reference to the aneroid observations at the sea coast, which had not come to hand when the original calculations were made; and I beg that the heights on the original sections, and in the reports, may be corrected according to the figures now furnished, which can be relied upon as correct.

3. As already intimated by a telegram, dated the 10th instant, I have been unable to finish the report and sections for the last portion of the reconnaissance, and to wind up the affairs of the reconnoitring party, before this; but I hope to do so by the end of the week, and intend to embark for Madras by the steamer of the 19th instant.

4. I shall thank you to instruct me whether I am to proceed to Ootacamund with my maps, field books and other papers, to give personally such further information, regarding the country reconnoitred, as the Government may desire to have.

5. Please address letters to me, till further notice, to Madras—General Post Office—to await arrival.

XXII.

From K. F. NORDMANN, Esq., Executive Engineer, on Special duty, to the Secretary to Government, Public Works Department, dated Camp Waltair, 18th April 1882, No. 74 W.

In continuation of my letter, No. 38-K., dated Kuraputi, 25th February 1882, wherewith I forwarded my report on the reconnaissance of the country between

Raipur and Kuraputi via Omorkót, I have the honor herewith to submit my notes on the last section of the reconnaissance, viz., from Kuraputi across the Jeypur plateau and down the Eastern Gháts to

* In a separate cover.

Enclosures 3.

1 Book of Section.

1 "Notes."

1 Appendix A.

Sálúr; together with 17 sheets of longitudinal sections* of the country traversed, illustrating the most practicable lines for a Railway across the plateau and down to

the plains; and three cross sections of streams.

2. In paragraph 5 of G.O., No. 2294 W., dated 16th September 1881, I was directed to ascertain the best of the alternative routes, (1) from Párvatipuram via Ryaguddah, east of the Noagarh Hills, to Raipur; and (2) from Sálúr over the Jeypur plateau and through Noagarh, west of the above hills, to Raipur.

3. All my papers on the subject are now before the Government. I have already, in my letter above quoted (paragraphs 19 and 20, to which I beg to refer), made an impartial, preliminary comparison between the two routes; and, reviewing the whole circumstances again, I find a difficulty in arriving at a verdict as to which of the routes is the better.

4. Out of upwards of a thousand miles of country reconnoitred, two routes distinctly present themselves as (to my mind) equally eligible; and the Government, with my notes, reports and sections, &c., before them, will be able to choose the route that seems to answer those purposes best which the Government have chiefly in view in this matter. These routes are laid down in detail on my maps, and they lie as follows:—

- (1.) *East of the Noagarh Hills.*—Párvatipuram (395 feet), Ryaguddah (687 feet), Bisemkattak (1,154 feet), Ombadóla (1,196 feet), Asurgor (699 feet), Bógur (628 feet), (cross the Tel Nadi); then following the course of the Sunder river via Tukla (686 feet), Kariál (803 feet), Kúmúna (857 feet), Torbor (949 feet), Sialjóri (1,047 feet), Jalbal, Nára (1,010 feet), Súarmál, Patrapáli, Telibanda (1,022 feet), Mahásamund (916 feet), Gorári (cross the Mahánadi), Arang (952 feet), to Raipur (963 feet); distance 372 miles.

This is the route which was recommended to me by Colonel Shaw-Stewart, R.E.—It is a very excellent route and by far the best to be found in that direction. It encounters scarcely any ghát work (except a little, north of Ombadóla), and its summit level is not more than 1,346 feet above mean sea level.

- (2.) *West of the Noagarh Hills.*—From Sálúr (570 feet) up the gháts to Meriapád Saddle (3,250 feet), thence along the Upper Jeypur plateau (averaging 3,000 feet) to Chikapar and Dumripur; down to Mádeoputi (2,500 feet); then following the course of the Kuradi Nallah downwards to Ránigar (2,018 feet); from there across the Jeypur Campaign country (averaging 2,000 feet elevation) to Nárangpur (1,918 feet), Paparhandi (1,922 feet), Dabgaon (1,984 feet), Bífepur (1,955 feet), Omorkót (2,021 feet), Béra (1,967 feet), Raigarh (2,101 feet), to the edge of the Jeypur table-land near Kóliapodur (2,100 feet); thence following the drainage downwards via Dindandi and Gourgáon to Risgáon (1,569 feet); from there along the banks of the Sorul or Sendor river via Tumaribahál (1,441 feet), Baltema (1,295 feet), Benkura to Karti; there cross the Pairi river, then following this river via Bourka (992 feet) and Kopra to Rajim (958 feet), there cross the Mahánadi, and then via Uparwára to Raipur (963 feet). The length of this line will vary from 356 to 343 miles, according to the gradients which may be accepted for the ghát portion.

5. On the western line the gháts are to be encountered, with a summit level of 3,250 feet (Meriapád Saddle). The gháts have been carefully explored, with the result that six practicable lines have been found, viz., five different lines to connect the Upper Jeypur plateau (having an average elevation of 3,000 feet) with the plains near Sálúr; and one line to connect the Upper Jeypur plateau with the lower plateau (which has an elevation of 2,000 feet).

6. The following are the different ghât routes, which have been described in detail in my "Notes" (11th and 12th March, and "Résumé")—*Vide* Sections, Sheet No. 17:—

- (a.) From Meriapâd Saddle to Pâchipenta Saddle, via Chandka, and Sunki valley, to the foot (4 miles north-west of Sâûr). Gradients varying from 1 in 50 to 1 in 75. Length 29 miles. Probable cost, at £10,000 per mile, £290,000.
- (b.) From Meriapâd Saddle via Meriapâd cutting (on the new Potingi Ghât), Bittrah valley, Lâvidy Saddle, High Sunkipenta, Sunki valley and Pâchipenta Saddle, to foot. Gradients varying from 1 in 50 to 1 in 125. Length 32 miles. This is the longest route of all, and has the easiest gradients. Cost, at £10,000 per mile, £320,000.
- (c.) From Meriapâd Saddle via Meriapâd cutting, Bittrah valley, Lâvidy Saddle, Chandka, head of Sunki valley, and Pâchipenta Saddle, to foot. Gradients from 1 in 50 to 1 in 92. Length 29 miles. Cost, at £10,000 per mile, £290,000.
- (d.) From Meriapâd Saddle to Meriapâd cutting; $2\frac{1}{2}$ miles; gradient 1 in 92. From Meriapâd cutting via the proposed Wondranghy viaduct and Rôdavalâ tunnel, to foot; gradient 1 in 50; length under 23 miles; total length $25\frac{1}{2}$ miles. Cost, at £10,000 per mile (besides £50,000 extra for tunnel and viaduct), £300,000.
- (e.) From Meriapâd Saddle to Meriapâd cutting, as before, $2\frac{1}{2}$ miles; gradient 1 in 92. From Meriapâd cutting via the proposed Wondranghy viaduct and Rôdavalâ tunnel, to foot; gradient 1 in 35; length 10 miles; total length 19 miles.—This is the shortest practicable line, and has the heaviest gradients. Cost, at £10,000 per mile (besides £50,000 extra for tunnel and viaduct), £240,000.

The Railway would traverse the upper plateau between the Meriapâd Saddle and the Limka Saddle (near Dumripur), a distance of 33 miles.

- (f.) From Limka Saddle, which is 2,880 feet above mean sea level, via Mâdeo-puti and the Kuradi valley to the foot of the hills near Rânigar; an easy descent of 862 feet which, in a length of 14 miles, can be accomplished at an average gradient of 1 in 85. Probable cost, at £8,000 per mile, £112,000.

7. The total distance from Vizagapatam to Raipur by the eastern or Pârvatî-pûram route is 372 miles. By the western route, via the Jeypur Hills, the distance would vary according to the gradients adopted for the ghâts.

By the longest ghât line, *vide* (b), paragraph 6 *supra*, the distance would be 356 miles, or 16 miles less than along the eastern route via Pârvatîpûram.

By the shortest line, *vide* (e), paragraph 6 *supra*, the distance would be 343 miles, or 29 miles less than by the eastern route.

8. The total probable cost of a narrow gauge line for each of the two routes (east and west of the Noagarh Hills) would stand thus:—

A.—East of the Noagarh Hills.

	£
372 miles at £5,000	1,860,000
Add for some heavy work north of Ombadôla (5 miles at £2,000)	10,000
Add for bridges	30,000
Total	1,900,000

The item of bridging is heavier on this line than on the other.

B.—West of the Noagarh Hills.

	£
Raipur to foot of upper plateau at Rânigar, 204 miles, at £5,000	1,020,000
Ghât from Rânigar to Limka Saddle, 14 miles, at £8,000	112,000
Limka Saddle to Meriapâd Saddle along the upper plateau, 33 miles, at £6,000	198,000
Ghât from Meriapâd Saddle to foot in the plain (4 miles north-west of Sâûr) by the longest route (b), 32 miles, at £10,000	320,000
Foot to Sâûr and Vizagapatam, 73 miles, at £5,000	365,000
Total	2,015,000
Or, Raipur to foot of upper plateau at Rânigar, 204 miles, at £5,000	1,020,000
Ghât from Rânigar to Limka Saddle, 14 miles, at £8,000	112,000
Limka Saddle to Meriapâd Saddle along the upper plateau, 33 miles, at £6,000	198,000
Ghât from Meriapâd Saddle to foot by the shortest route (e), 19 miles at £10,000	190,000
Add for Tunnel and Viaduct	50,000
Foot of hills to Vizagapatam, as before, 73 miles, at £5,000	365,000
Total	1,935,000

9. As regards the gauge on which the new Railway is to be constructed, it is, I submit, a matter for consideration whether a narrow gauge line will fully answer the requirements of the great traffic, partly already existing and partly to be further stimulated and developed by the Railway. It has to be considered that this Railway will tap a large tract of country, about equal to France in size, and with a population of some forty millions. But if, for reasons of present economy, the line is made a narrow gauge one, I would strongly advocate that, in view of future requirements, all the bridges at least be built sufficiently strong to carry the additional weight consequent upon a broad gauge line; in case the gauge should have to be eventually changed, as will most likely be the case.

10. If the Railway is made by the eastern route via Pârvatîpûram, Ombadôla and Asurgor, the line would seem naturally to trend in a northerly direction; and might be continued from the last-named place via Banpur to Turla, there cross the Têl Nadî, then proceed along the left bank of the river via Bamini to Sônpoor, and thence along the western bank of the Mahânadi, via Binka, to Sumbulpoor, crossing the Mahânadi there.

This subject has been alluded to in my letter, No. 24-R., dated Raipur, 6th January 1882, paragraph 8.

11. In case the Railway should be taken from Raipur to Sumbulpoor direct, along the old trunk road, crossing the Mahânadi twice, namely at Gorâri and Sumbulpoor; the line from Vizagapatam need not go to Raipur at all, but might from Jalbal be taken north, via Onki, along the eastern bank of the Jong river, and there join the line from Raipur to Sumbulpoor; whereby about 55 miles of Railway would be saved.

There need be no objection, on the score of economy, to crossing the Mahânadi twice, as above mentioned; for, if the line from Raipur is taken north of the Mahânadi, by Belaspur, &c., the amount of drainage encountered there would considerably exceed that south of the Mahânadi plus the double crossing of the latter. This is accounted for by the numerous large tributaries entering the Mahânadi from the north between Arang and Sumbulpoor.

12. It is not advisable to take the line from Singapore via Lonjigar to Ombadôla, as there is much hilly ground (a small ghât in fact) encountered between Singapore and Lonjigar, and an altitude of 1,603 feet (at Tirmui) has to be overcome.

13. The route from Ryaguddah via Singapore, the Mûsa Ghât, Bondesor and Dâdpar to Bôgar has been carefully examined and must be considered objectionable for a Railway, owing to the Mûsa Ghât, the head of which is 2,048 feet above mean sea level; while, by taking the route via Bisemkattak and Ombadôla, this ghât can be avoided.

14. The route mentioned * by Colonel Lucie-Smith, viz., from the Músa Ghát via Nandól, Daspur and Lorka, to Polsodár on the Sunder river (where it would meet my line from Kariál to Kúmná), naturally shares the fate of the Músa Ghát, and must be rejected for the purposes of the Railway if the ghát is rejected. But, with a view to opening out that part of the country, an ordinary cart-road should be made along Colonel Lucie-Smith's line, as well as from the Músa Ghát southwards via Singapore to Ryaguddah. —This road would serve as a feeder to the Railway if the latter is taken along the eastern, or Ombadola, route.

15. Similarly, the line recommended from Torbor (where it leaves my line) via Limdi, Tarnot, Sirábong, Tendubarra, Sirgidi, Bodrabanda, Kamaría and Kárti to Mahásamund (where it joins mine again), although a very good one for an ordinary road, has this drawback for a Railway, that the line encounters two small gháts (near Tárnot and Sirgidi) with an elevation of upwards of 1,500 feet; while the route via Jalbal, Nára and Súarmál, which is very little longer, meets no such obstacles; and its summit level is about 400 feet lower.

This subject has been reported on in my letter, No. 24-R., dated Raipur, 6th January 1882, paragraphs 9 to 11.

16. The line from Raipur via Dhamtari and Kankér to Omorkót, or Raigarh, is 13 miles longer than that via Rájim, along the Pairi river, through the Bindra-Nagar Estate, and then up the Sorul or Sondor river. It would no doubt be desirable to take the rail via Dhamtari, which is situated in the very heart of a rich grain-producing country. But, besides being a long one, this line would encounter some difficult ghát work in the Hatkul Valley, south-east of Kankér; while the grain country is also tapped by the Rájim line, although not to the same extent as it would be via Dhamtari.

This line has been discussed in my letter, No. 38-K., dated Kuraputi, 25th February 1882, paragraphs 10 and 11.

17. The lines examined and reported on by Colonel Francis, between Dhamtari, Sihóá and Borái must be considered, on account of the hilly nature and irregular configuration of the country, as not eligible for the purposes of a Railway, when there are other and better lines. But the easiest of that officer's routes (that via Kukrel, Dókál, Gatásili and Burgudi) should be opened as an ordinary cart-road; when it would act as a feeder to the Railway.

I have submitted a copy of Colonel Francis' report, with my letter No. 38-K., dated 25th February 1882, paragraph 17.

18. Altogether, the reconnoitring party has travelled upwards of 1,100 miles, as specified in the margin.†

	MILES.
† Vizagapatam to Raipur via Párvati-púram and Ombadola	372
Raipur to Vizagapatam via Kuraputi	356
Ryaguddah via Músa Ghát and Bode-sor to Bógor	100
Raipur via Dhamtari and Kankér to Omorkót	150
Nárangpúr to Maribatta	50
Pupagaon via Jeypur to Kuraputi	24
Jalbal to Onki and back	50
Singapore via Lonjigér to Ombadola and back	40
Total	1,142

19. The perambulators used were by Elliot Brothers, of London. The party was supplied with 11 aneroids, viz., 5 by E. J. Dent, 3 by T. Cooke and Sons, 2 by L. Casella, and 1 by Negretti and Zambra; which were compared, and set, at the Public Works Stores in Madras, before being despatched. Of these, six that read best together were formed into two batteries of three each; one battery being

kept and observed by the Master Attendant at Vizagapatam, while the other was registered in camp by myself daily at 11 A.M. and 4 P.M.

The other aneroids were carried about on the march and registered at every mile, at every stream, and at every change of level in the ground.

For calculating the altitudes, the hypsometrical tables of Major Morant, R.E., were used.

20. I cannot close this report without bringing to the special notice of Government the good services of my Assistant, Mr. J. Cormac, Sub-Engineer, who throughout the whole expedition has shown the most praiseworthy zeal, has been indefatigable in the discharge of his duties, and rendered me very valuable assistance; combining, as he did, great intelligence with arduous work and perseverance under difficulties. Two hundred and fifty miles of the country explored were reconnoitred by him alone, and I have submitted his own original notes and reports on these. I should be glad if the Government would acknowledge his good services by granting him a step in promotion, namely from the 2nd to the 1st grade of Sub-Engineers.

21. I enclose an Appendix (1 A), containing a description of the preparations for the expedition, which Appendix I beg may be placed at the head of such of my papers as are to be printed in connection with the Reconnaissance.

22. The tents, stores, instruments, &c., have been handed over to the Executive Engineer, Vizagapatam Division, in accordance with memorandum No. 607-C., dated 8th March 1882, from the Chief Engineer.

XXIII.

Notes of Reconnaissance of the Eastern Gháts from Kuraputi to Sálúr, 6th to 16th March 1882.

6th March, Kuraputi to Chikapár.—Having finished the report on the reconnaissance from Raipur to Kuraputi, and the sections appertaining thereto, the survey party left Kuraputi on the 6th March 1882 to undertake the last portion of the work, namely across the Jeypur plateau and down the Eastern Gháts to Sálúr.

From Kuraputi I first proceeded to Mastiput, a distance of 3½ miles, and took up the proposed Railway line there, where I had ceased work on the 16th of February. Mastiput is 214 miles from Raipur.

The aneroid battery, which had been of no use at Kuraputi, here began to work again, Mastiput being 2,520 feet above mean sea level. The aneroids in the battery, being figured only up to 27·50, could not be registered at an elevation exceeding 2,500 feet.

Marching from Mastiput towards Dumripur, a stream was crossed at the 2nd furlong, measuring 25 feet × 6 feet, in flood. At one mile one furlong is the village of Dengagura, which is conveniently situated for the future Kuraputi Railway station: a valley leading from here to Kuraputi, along which a hill-side road could be easily and cheaply made to connect the two places which are 2½ miles apart.

The track proceeds along the bank of the Kuradi Nullah; there is some low scrub jungle about; the soil is hard and light.—Low hills on the left.

At 1 mile 2 furlongs a stream, 25 feet × 8 feet. The ground then becomes somewhat irregular, and some cutting and embanking will be required.

At 2 miles 5 furlongs a small stream, 8 feet × 5 feet; the ground is hilly and irregular, and rather stony.

At 2 miles 6 furlongs the Kuradi Nullah (25 feet × 8 feet) is crossed again by the track; there is some hilly jungle about; no cultivation.

The hill side is stony, occasionally rocky; the soil brown clay mixed with sand. There is a rise from Mastiput up to this of 150 feet or 1 in 97.

The road about here would be mostly in hill-side cutting, and some rock blasting required, but not much.

In the 4th mile a stream is crossed, 15 feet $\times$ 5 feet.

At 3 miles 6 furlongs the track leads over a saddle, 360 feet above the starting point.

The soil is light clay, rather stony.

At 4 miles a stream, 25 feet $\times$ 9 feet; then another, 18 feet $\times$ 7 feet.

At the 5th mile there is some dry cultivation; no jungle.—Soil, brown clay.

Before joining the high road from Kuraputi to Potingi, the village of *Nigamungura* is reached, where there are some paddy-fields. A stream, 25 feet $\times$ 7 feet, is crossed; and at 5 miles 6 furlongs the high road is joined.

The village of *Dumripur* was passed, and at 6 miles 7 furlongs the *Karandi* stream was reached, 30 feet $\times$ 9 feet, with soft clayey banks and muddy bed.

Then another stream, 14 feet $\times$ 5 feet.

At 7 miles 7 furlongs 143 yards the day's work was brought to a close, to be resumed to-morrow.

The party at this point left the high road to proceed to the site of the old *Chikapár* bungalow where the camp had been pitched.

As regards the fitness for a Railway of the line traversed to-day from Mastiput to Chikapár bridge, distance 8 miles, the section shows that, up to 1 mile 1 furlong 92 yards, the maximum gradient required would be 1 in 155; thence to 2 miles 6

furlongs 47 yards, 1 in 76; and up to the saddle 1 in 25.*—From the saddle, by which the line enters on the Jeypur plateau (averaging 3,000 feet in elevation), there

is a gentle descent of 101 feet in 4 miles 1 furlong and 90 yards. This descent includes some undulating ground which has to be negotiated in detail; but there is nothing serious in the way of cutting or embanking required, and a good line could be easily laid out.

7th March, *Chikapár to Dóliámb*.—Distance 9 miles 3 furlongs.

We joined the public road where work was left off yesterday, and marched towards Potingi.

At the 2nd furlong the *Karandi* stream was crossed, over which there is a temporary timber bridge. The banks of the stream are steep and soft, the soil is tenacious clay, the bed sandy and muddy alternately; there is no visible rock near for foundations.

Some dry cultivation along the route; no jungle.

At 2 miles 7 furlongs the road passes over a saddle not far from the village of *Kakkigám*.

A drainage channel 12 feet $\times$ 4 feet is crossed.

The prevailing soil is stiff clay.

At 4 miles 5 furlongs the old Police Station at *Semligura* was passed.

At 5 miles 7 furlongs a stream, 30 feet $\times$ 8 feet; with steep, soft banks and sandy bed; no rock near for foundations.

Some wet and dry cultivation; no jungle. The soil here is brown clay; some laterite rock occurs near the road, a few feet below the surface.

7 miles 70 yards; stream 24 feet $\times$ 8 feet, with steep, clayey banks. Some light scrub jungle.

At 8 miles 6 furlongs, the village of *Márliput* was passed.

At 9 miles 143 yards a stream, 45 feet $\times$ 7 feet; bed, clay and shingle; soil, red clay; some laterite; the banks are sloping; the bed during floods is large and well defined; there is a distinct channel in the centre where the water at present runs about 4 feet deep.

At 9 miles 3 furlongs the camp near *Dóliámb* was reached, where there is both wet and dry cultivation. Jungle on the hill side.

To-day's march lay entirely along the 3,000 feet plateau; the ground undulates considerably; but a good and easy line for the Railway can be obtained by keeping along the low ground as much as possible, and generally following the course of the longitudinal valleys leading in the direction of the proposed line.

Some high embankments would be required, but not much cutting. The soil is easy, the drainage to be crossed moderate, and there is not much rock.

8th March, *Dóliámb to Dókrigát Saddle*, 11 miles 4 furlongs. *Dókrigát Saddle* to *Meriapád* camp, 7 miles 6 furlongs. Total distance 19 miles 2 furlongs.—Continued along the public road for some distance from *Dóliámb*.

At 1 mile 4 furlongs 187 yards a stream was crossed, 25 feet $\times$ 10 feet, with steep clayey banks; bed, sand with shingle.

Some dry cultivation.

Prevailing soil, stiff clay.

Here we left the road and marched towards the village of *Kundili*, at the third mile, where ample wet cultivation was seen.

Beyond the village, the track passed over a tank bund.

At 3 miles 5 furlongs, a stream flowing into the *Koláb* was crossed, 35 feet $\times$ 9 feet, with steep clayey banks, and firm bottom; no rock visible. The ground here is somewhat undulating.

The track follows the course of the river just crossed; there are hills on both sides; the slopes are cultivated.

At 4 miles 5 furlongs the village of *Temba* was passed; *Dusra* was left on the right, on the other side of the stream. We then passed along a narrow valley where some hill-side cutting for the road would be required.

The main path leading from Potingi to Nandapur was met.

At 5 miles 5 furlongs a stream, 25 feet $\times$ 8 feet, flowing into the stream last crossed.

At 5 miles 8 furlongs, the village of *Kirajóla Dusra* was reached. Here are some dry fields, chiefly with ragi; and some gardens with castor-oil and plantain trees. Hills and jungle around.—In the 7th mile the last-mentioned stream was again met, and then its course followed up along the narrow valley, where some hill-side cutting would be required for the road.—Much dry cultivation around.

7 miles 4 furlongs.—Near the village of *Déo Potingi*; at least one of the villages of that name: there are several.

We passed between *Déo Potingi* and *Sargigura*.

At the 9th mile the last stream was crossed once more. The soil here is red clay. There is some dry cultivation. Thin scrub jungle and stunted date grow all around. Some hill-side cutting for the road required.

At 9 miles 6 furlongs, passed through another *Déo Potingi* which seems to be the chief of the several villages of that name about here.

Then the path led through a gorge, where much hill-side cutting would be needed.

A small irrigation channel, coming from the head of the gorge (the *Dókrigát Saddle*) and flowing towards *Déo Potingi*, is led along the hill-side.

Beyond the gorge there is some flat ground again, breaking into irregular features here and there.

At 11 miles 4 furlongs, we arrived in the *Dókrigát Saddle*, having come at a steady ascent (about 300 feet) all the way from the village of *Kundili*.

The height of this saddle above mean sea level is 3,190 feet.

The track through the saddle is a short cut from *Kundili* to *Meriapád*; the easier but somewhat longer route lies along the valley of the *Koláb* river, further west.

From *Dókrigát Saddle* the lower ground to the south is overlooked wherein the village of *Pukáli* lies, to which the track descends rapidly from the saddle. But a gradual descent on an easy gradient can be obtained by keeping along the hill-side to the east, instead of descending at once.

Having no topographical maps of this part of the country, on the scale of one mile to the inch, and the Ordnance map being incomplete for these parts, as it does not show the hills (the chief feature here), I had under-estimated the distance from *Dóliámb* to *Meriapád*, and sent the camp ahead to the latter place, along the main road via Potingi and then down the new ghát. So that from *Dókrigát Saddle* (which I left at 11 a.m.) I had to march across country, over hill and dale, through the jungle, to *Meriapád*.

We marched along the hill-side, passed through the village of *Sangamgura*, and at the 13th mile got into another saddle connected with the last by a ridge, and about 90 feet lower.

At last we reached the camp at Meriapád at 2-30 p.m., the thermometer in the aneroid box showing 105° F.; having marched 21 miles since 6 a.m., taking observations, notes, &c., and never halted.

Meriapád is near the edge of the 3,000 feet plateau, and is at the natural head of all lines of communication that can be brought up from the Sálúr plains to the plateau, in this direction.

The Meriapád Saddle, 3,250 feet above mean sea level, a mile to the west of the village, is the natural ghât head for all ghât lines converging here.

If it should be decided to take the Railway over the Jeypur plateau, there is nothing encountered in this day's march, to form any obstacle or difficulty. No gradients steeper than 1 in 70 need be used; the amount of hill-side cutting required is by no means formidable, while scarcely any rock is met.

9th March, Potengi.—Inspected the new ghât, as far as Potengi, and confirmed my previous impression based upon careful examination of the country, some years ago, that this portion of the line should not be used for the Railway; the proper ghât head being at Meriapád and not at High Hadmári. Indeed, if Potengi had not been, chiefly with reference to Mr. Turner's Taudivalsab Ghât, made an obligatory point, nine years ago, when the new ghât was traced by me, this ghât would have entered upon the plateau at Meriapád, and not at Hadmári or Potengi. Thus the new ghât would have been four miles shorter than it is at present, and its head 250 feet lower.

It is a matter for consideration whether it is, even now, too late to change the upper part of the new ghât by abandoning that portion north of the Meriapád cutting (where the shaft was sunk), tracing thence into the Meriapád Saddle, taking the road from that to Pukeli; and thence either via Dókrigát Saddle and Déo Potengi, or else along the valley of the Koláb, towards Kundili, near which village the main road to Kuraputi would be joined. This would do away with Potengi as a station on the main road; the fertile Koláb valley would be opened out; and Pootapád, Pukeli and Kundili would then become important points on the new road.

10th March, Meriapád to Dókrigát Saddle.—This march was undertaken to obtain a complete longitudinal section of the line between the Meriapád and Dókrigát Saddles, which are nearly on the same level.

We first worked into the Meriapád Saddle, which is 2½ miles from the camp, and 3,250 feet above mean sea level.

From this saddle to Dókrigát Saddle (3,190 feet above mean sea level) the distance is 7 miles 6 furlongs. At 1 mile 1 furlong, we arrived opposite the village of Sandaka, which is on the other side of the valley. The track leads along the hill-side on the left; the soil is light; there is no rock visible. Some dry cultivation, and a little jungle. The ground is alternately flat and side-lying; hill-side cutting would be required in places.

At 1 mile 7 furlongs, a small nullah was crossed, 10 feet x 4 feet; 160 yards further another nullah, 16 feet x 4 feet. Here the track changes from the left to the right side of the valley. Patches of jungle and dry cultivation occur alternately.

At 2 miles 5 furlongs the last stream is crossed again, and the track changes back to the left side of the valley.

The ground here is rather irregular.

At 3 miles 5 furlongs a small nullah, 12 feet x 4 feet. Hilly jungle.—Soil, brown clay.

The longitudinal section here shows a considerable dip, because the track descends unnecessarily low; the road would avoid this dip by crossing the valley somewhat higher up.

At the fourth mile the track passes through the Pukeli Saddle, and then descends towards the village of Pukeli. But the saddle can be circumvented by following the course of the nullah last crossed.

We passed a small hamlet belonging to Pukeli, and called Pukeliguda, situated on a gently sloping hill-side.

There is some dry cultivation near this village.

At 5 miles 6 furlongs the village of Pukeli was passed en route to the Dókrigát Saddle. There is extensive wet and dry cultivation near the village. Half-a-mile north of Pukeli a stream is crossed, flowing into the Koláb river.

From here the line may either follow the course of the Koláb river to Kundili, or be taken up into the Dókrigát Saddle; but the former is the easier line for a Railway. In case the road is taken through Dókrigát Saddle, the ridge on the eastern side will take the line from the saddle down towards Pukeli at a maximum gradient of 1 in 70.

From Dókrigát Saddle we returned to Pukeli, a distance of 2 miles, where the camp had been pitched.

The distance marched to-day was as follows:—

	M.	F.	V.
Meriapád Camp to Meriapád Saddle	...	2	4 0
Meriapád Saddle to Dókrigát Saddle	...	7	6 92
Dókrigát Saddle to Pukeli Camp	...	2	0 42
Total	...	12	2 134

The march to-day was chiefly through a broad valley; some intricate ground was passed over near Pukeli, but nothing was encountered that could be considered a serious obstacle to tracing a suitable line for a Railway.

11th March, Pukeli to Meriapád via Pútapár.—Distance 9 miles 6 furlongs.

We marched back from Pukeli to Meriapád Saddle along the route described yesterday.

From Meriapád Saddle we followed the Brinjarri track leading into the old and new ghâts between Lávidy and Pútapár. The track is an easy one and leads chiefly along a gently sloping hill-side.

The Railway should descend the hill-side at 1 in 75 from Meriapád Saddle, keep above the present ghât and above Lávidy Saddle, pass Chandka and enter the valley of the Sunki river not far from Páta Lávidy. It would then cross the Sunki valley, as high up the stream as may be found convenient, and proceed along the southern slope of the valley into the Páchipenta Saddle, i.e., the head of the old Páchipenta Ghât, south of the Sunki stream.

Or, another line could be run as follows:—

From Meriapád Saddle into the Bittra valley; then through a cutting, to be made in the low ridge near Volagah; along well-wooded hill-sides into Lávidy Saddle; thence either via High Sunkipenta, or via Lávidy and Chandka, into the Sunki valley; across the Sunki stream, and into Páchipenta Saddle, as before.

From Páchipenta Saddle, which is 2,213 feet above mean sea level, there is a descent of 1,443 feet to accomplish, and there is a length of 14 miles of hill-side available to get to the foot of the hills (4 miles north-west of Sálúr); so that a line could be traced at a gradient of 1 in 50, which gives a fall of 105 feet per mile. Much heavy rock would be encountered on these last 14 miles, and a number of large stone revetments would have to be built.

The work on the plateau, i.e., above Páchipenta Saddle, would be rather easy compared to that on these 14 miles; the outer (southern) face of the ridge being very stony.

From the foot of the hills an easy descent of 1 in 100, for 4 miles, takes the line into Sálúr which is 569 feet above mean sea level, 100 feet above Rámabhadrapúram, and 175 feet higher than Párvatipúram.

12th March, Bittra Valley Line.—Went to reconnoitre the Bittra valley and to refresh my memory about its features which I had very carefully examined in 1873, 1874 and 1875.

The summit level of this line is also the Meriapád Saddle. The road can be taken down from that saddle, along easy hill-sides, by a gradient of 1 in 50 to the site of the proposed viaduct, 1,500 feet long, 1,622 feet above mean sea level, and 150 feet above the bed of the Wondranghy stream; there we should have to pierce the Ródavalsa ridge by a tunnel 2,000 feet long, and emerge on the southern face of the ridge at the same elevation, i.e., 1,622 feet above mean sea level, or 852 feet above the foot of the hills (which is 4 miles north-west of Sálúr). To accomplish this descent, at a gradient of 1 in 50, would require a length of about 8 miles which is available on the same hill-side along which the new Potengi Ghât is being made, and along which the Railway from Páchipenta Saddle would come down.

As in the case of the latter, so also here, a considerable amount of rock would have to be blasted, and a number of heavy stone revetments to be built, on these 8 miles.

13th March, Meriapád to Dóbata.—Went along the new ghât, as far as Lávidy Saddle; thence along the cattle track leading to Lávidy, Chandka and Súnki. Passed the village of Páta Lávidy. Then entered the valley of the Súnki stream, followed its course downwards to Súnki, and returned by the old ghât to High Súnkipenta, and thence by the new ghât to the camp at Dóbata, just under Lávidy Saddle.

14th March, Dóbata to Súnki.—Proceeded along the new ghât to Súnki, crossed the Súnki stream (which contained very little water) and ascended the old ghât to its summit level on this side (Páchipenta Saddle). Fixed the height of the latter (2,213 feet), and explored the hill-side with a view to the location of the line of rail, in case it should be decided to bring the line here.—Then returned to the camp at Súnki.

15th March, Súnki to Ródavalsa.—Marched along the new ghât, as far as the cutting on Ródavalsa Saddle.

Thence descended the steep hill-side into the rocky bed of the Wondranghy stream, and examined the sites of the proposed viaduct and tunnel.

Fixed altitudes, &c., and then returned to the camp on Ródavalsa Saddle, which saddle is 2,001 feet above mean sea level.

16th March, Ródavalsa to Sálúr.—Went along the new ghât to the foot, and then along the new line of road being constructed from the foot to Sálúr. There I closed the field work of the last section of the Reconnoissance.

Résumé.

As the result of my exploration of the ghâts, on this occasion as well as in previous years, I have arrived at the conclusion that the routes above mentioned (*vide notes for 11th and 12th March*), and described as accurately as they can be without actual levels, &c., having been taken, represent the shortest and most practicable lines (subject to modification in details) that can be found for a Railway ghât from Sálúr to the Jeypur plateau. Other lines may be possible, but those here specified offer a minimum of obstacles and difficulties.

These routes are:—

I.—The Lávidy and Súnki Line.

(a.) From Meriapád Saddle to Páchipenta Saddle via Chandka and Súnki valley.

MILES.	
15	Fall 1,037 feet; gradient 1 in 75;
14	length 15 miles (Section No. 6).
4	From Páchipenta Saddle to foot (4
33	miles north-west of Sálúr). Fall 1,443

(Section No. 10).

From foot to Sálúr. Fall 200 feet; gradient 1 in 100; length 4 miles (Section No. 15), total 33 miles.

(b.) Or, from Meriapád Saddle to Meriapád cutting (on the new Potengi Ghât).

2½	Fall 143 feet; distance 2½ miles;
7½	gradient 1 in 92 (Section No. 11).
2½	From Meriapád cutting into the
5½	Bittrah valley and to Lávidy Saddle. Fall
14	507 feet; gradient 1 in 75; length 7½
4	miles (Section No. 7).
—	From Lávidy Saddle to High
35½	Súnkipenta; fall 106 feet; distance 2½

From High Súnkipenta via Súnki valley to Páchipenta Saddle; fall 281 feet; gradient 1 in 100; length 5½ miles (Section No. 9).

From Páchipenta Saddle to foot; fall 1,443 feet; gradient 1 in 50; length 14 miles (Section No. 10).

Foot to Sálúr; fall 200 feet; gradient 1 in 100; distance 4 miles (Section No. 15).

Total length, 36 miles.—This is the longest route of all, and has the easiest gradients.

(c.) Or, from Meriapád Saddle via the Bittrah valley to Lávidy Saddle, as before, 9½ miles (Section No. 7).

9½	From Lávidy Saddle via Chandka
5½	and the head of the Súnki valley to
18	Páchipenta Saddle; fall 387 feet, gradient
—	one in 75; length 5½ miles.
33½	Páchipenta Saddle to Sálúr, as before,

18 miles; total length 33½ miles.

II.—The Bittrah Valley Line, with Viaduct and Tunnel.

(d.) From Meriapád Saddle to Meriapád cutting, as before; distance 2½ miles. From Meriapád cutting to Wondranghy stream; roadway of viaduct 150 feet above bed. Fall 1,485 feet; gradient one in 50; length 14 miles (Section No. 11).

2½	Wondranghy Viaduct, and Ródavalsa
14	Tunnel; combined length 3,500 feet
—	(Section No. 16).
8½	From south entrance of tunnel, to
4	foot (4 miles north-west of Sálúr); fall
—	852 feet; gradient 1 in 50; length 8½
29½	miles (Section No. 13).

From foot to Sálúr; fall 200 feet; gradient 1 in 100; length 4 miles; total length 29½ miles (Section No. 15).

(e.) Or, from Meriapád Saddle to Meriapád cutting, as before; distance 2½ miles. From Meriapád cutting to viaduct, at a gradient of 1 in 35; length 10 miles (Section No. 13). Viaduct and tunnel, as before, ¾ mile. Tunnel to foot, at 1 in 35; 5½ miles; foot to Sálúr, 4 miles; total 23 miles.

This is the shortest practicable line,

and is shorter than the new Potengi Ghât which is now being made.

The steep gradient may be considered objectionable for a Railway; but Railways on similar gradients have been made in other parts, for instance over the Alps (the Semmering Pass in Austria, and the Brenner Pass in Bavaria); over the Western Ghâts near Bombay (the Bhoré and Thull Ghâts); and others.

WALFAIR,
18th April 1882.

(Signed) K. F. NORDMANN,
Executive Engineer.

XXIV.

STATEMENT of Particulars describing Mr. Nordmann's Route—from Párvatipuram to Raipur.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.				
85 7 4	..	..	395.3	..	..	Belagampareatipuram.
		1 1 63	360.0	..	..	Town of Parvatipuram.
		2 3 137	385.0	..	..	Sandy loam kunkur underlying.
		3 3 147	385.0	..	..	Village of Fikunapuram. Dry cultivation.
		4 3 156	340.0	..	..	Junction with Kurupam road. Wet and dry cultivation.
		5 4 143	318.0	..	..	Dry cultivation.
		6 3 182	310.0	..	..	Village of Jungaleelasa.
		6 6 176	..	..	..	Narainpatnam. River, Section No. 1. Village of Kotapam.
		7 7 173	275.0	..	..	Stream 20' X 4'.
		9 1 23	..	..	..	Do. 10' X 4'.
		10 0 120	..	..	..	Village of Komarada. Station-house. Cultivation under tank.
		10 3 55	280.45	..	114.85	Stream 20' X 6'.
		1 1 87	270.0	..	..	Village of Kanatlapeta. Undulating country.
		2 1 92	250.0	..	..	Sandy light loam.
		3 2 46	340.0	..	..	Jungle.
		4 4 163	260.0	..	..	Wet cultivation. Jungle.
		4 7 133	..	..	..	Undulating irregular ground. Sandy clay. Little cultivation.
		5 6 81	260.0	..	..	Stream 10' X 4'.
		6 6 141	340.0	..	..	Do. Section No. 2.
		8 9 184	360.0	..	..	Do. No. 3. Oil-seeds and sugarcane.
		9 2 68	403.0	..	..	Sandy soil.
		9 4 48	..	..	..	Stream 4' X 3'. Wet and dry cultivation, and jungle. Ground broken and undulating.
		10 4 129	423.8	203.35	..	Stream, Section No. 4.
		1 2 55	513.8	..	..	Village of Jummadahpattak.
		2 7 46	433.0	..	..	Jungle and dry cultivation.
		2 7 77	..	..	..	Stream 15' X 7'.
		3 3 50	420.0	..	..	Do. 15' X 10'.
		4 1 185	420.0	..	..	Do. Section 5.
		4 2 9	..	..	..	Road runs by river Nagavully.
		5 1 50	470.0	..	..	Stream, Section No. 6. Jungle with little cultivation in patches.
		5 7 17	483.0	..	..	Khond Village of Juddah. Dry cultivation.
		7 3 159	568.0	..	..	Dry cultivation. Light sandy soil.
		9 1 215	540.0	..	..	Village of Pittanmsley. Light sandy soil.
116 6 0	30 6 216	9 7 1	587.0	204	..	River, Section No. 7.
		1 4 30	669.0	..	..	Ryagudah. Light soil. Dry cultivation.
		2 4 37	637.0	..	..	Dry cultivation.
		3 7 79	657.0	..	..	Village of Kulligoodah. Ground somewhat broken. Stream 6' X 4'.
		5 4 187	617.0	..	..	Village of Pradiguda. Top for camping. Dry cultivation; some wet.
		6 6 104	667.0	..	..	Village of Conelypettah. River, Section No. 8.
		8 1 189	709.0	22	..	Level upland country.
		8 6 147	736.0	49	..	Some jungle. Village of Jugganahpette.
		1 3 132	764.0	..	..	Village of Gingerabadi. Soil dark brown clay, nearly black.
		3 1 50	778.0	..	..	Gingerabadi. Ground becoming more uneven. A good deal of jungle. Jungle and cultivation; some wet cultivation under stream. Soil alternately sandy and clayey loam.
		3 2 110	706.0	..	..	Dry cultivation. Jungle and patches of cultivation. Rock.
		4 3 126	778.0	..	..	Dry cultivation. Sandy soil.
		6 0 118	794.0	..	..	Stream, Section No. 9. This river lies in a deep valley.
		6 4 74	766.0	..	..	Village of Gajepada. Dry and wet cultivation. Ground somewhat undulating. Small planted tops of young trees. Village of Sanda-Bandi-pam. Sandy track; slightly undulating.
		7 6 76	876.0	..	..	Stream, Section No. 10. Jungle and cultivation.
		8 6 44	904.0	..	..	Sandy track. Village of Bathiparam.
		10 0 27	1072.0	..	..	Stream, Section No. 11. Hilly jungle. Broken ground. No cultivation.
		10 4 123	1136.0	400	..	Jungle with patches of cultivation.
		1 5 92	1206.0	..	..	Ballung.
		2 6 48	1286.0	..	..	Hill side cultivated in patches.
		3 2 176	1196.0	..	..	Very low patches of cultivation.
		4 0 91	1236.0	..	..	Stream, Section No. 12.
		4 2 176	1258.0	..	..	Do. 10' X 15'.
				..	..	Ground uneven, cut up by gullies.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.				
		4 6 104	1298.0	..	..	Soil sandy brown clay. Bifurcation of roads eastern to Bisenkattak, western to Raipur via Tikirapara.
		5 3 147	1316.0	..	..	Jungle and patches of cultivation. Reddish sandy clay. Jungle with little cultivation.
		6 4 109	1276.0	..	..	Village of Matakari. Wet and dry cultivation.
		7 5 147	1176.0	..	..	Village of Bataguda. Dry cultivation and jungle.
		9 0 69	1156.0	..	..	Jungle with recent clearing and sparse dry cultivation.
146 3 187	29 4 191	10 1 141	1154.0	18	..	Bisenkattak in the midst of hills and jungle. Paddy-fields. Stream, Section No. 13.
		2 1 98	1194.0	..	..	Jungle.
		3 3 134	1104.0	..	..	Stream 10' X 5'. Some dry cultivation. Village of Galkana. Stream 25' X 5'. Some wet cultivation. Village of Burchiguda. Extensive wet cultivation.
		5 3 142	1054.0	..	..	Dry cultivation in jungle. Village of Depaguda. Extensive wet cultivation. Stream 25' X 5'. Village of Dandra. Jungle; few patches of clearing.
		7 2 208	1104.0	..	..	Village of Tikirapara. Wet and dry cultivation.
		8 4 16	1104.0	..	..	Stream, Section No. 14.
		9 4 173	1094.0	..	..	Jungle. Dry cultivation. Village of Jomaraguda.
		11 1 204	1194.0	..	..	Village of Chellanalla. Fine tops for camping.
		12 0 67	1192.7	38	..	Stream 10' X 5'. Jungle cleared here and there.
		1 3 75	1100.0	..	..	Dry cultivation.
		3 1 211	1050.0	..	..	Kordaband. Fine tops for camp. Stream 10' X 5'; stream 10' X 5'.
		3 7 82	..	..	..	Jungle and dry cultivation. Stream 10' X 5'.
		5 2 191	1070.0	..	..	Village of Dohal. Stream, Section No. 15. Paddy and dry cultivation, sugarcane.
		6 6 187	1060.0	..	..	Village of Kondugura. Stream 25' X 5'. Undulating country. Hills on both sides. Tree, jungle, patches of dry cultivation.
		7 2 47	..	..	..	Village of Sioapetro and Dombist. Small ghât stream 15' X 5'; stream 8' X 3'.
		8 5 27	1182.0	..	..	Hilly undulating ground. Jungle and dry cultivation.
		9 3 17	1152.0	..	..	Stream, Section No. 16. Dense jungle. Hill side cutting required. Flat country.
		10 0 67	1082.0	..	..	Village of Chankuti.
		11 7 18	1196.0	4.0	..	Village of Paddagudah. Village of Ramguda.
170 3 52	23 7 35	0 5 0	1234.0	..	..	Bongdara River, Section No. 17.
		1 7 78	1234.0	..	..	Fine tops for camping; Ombodola.
		2 7 0	..	..	..	Stream, Section No. 18. Planted tops alternating with jungle and dry cultivation.
		3 5 153	1296.0	..	..	Village of Kunrabal. Stream 10' X 4'. Village of Bijapuram. Jungle and dry cultivation.
		4 2 0	..	..	..	Village of Ishapur. Jungle with a little dry cultivation.
		4 5 197	1156.0	..	..	Summit stream 6' X 4'.
		5 3 26	1136.0	..	..	Village of Banpur. Gneiss rock with quartz jungle.
		7 0 176	1076.0	..	..	Stream, Section No. 19. Broken ground; stony soil; soil clay with kunkur.
		8 1 121	1066.0	..	..	Jungle and rock cropping out. Irregular ground broken and undulating. Stream 6' X 4'.
		9 2 21	996.0	..	..	Village of Boreguda. Dry cultivation in the midst of jungle.
		10 3 0	..	..	..	Village of Dangan. Dry cultivation surrounded by jungle. Ground undulating and cut up by gullies. Soil red clay.
		11 0 50	..	..	..	Boundary of Katakundi. Tracks to Lonjigar and Boudaar diverge at this point. Dense jungle; stony soil. Village of Syriguppa. Forest of large trees.
		11 5 175	927.0	..	269	Stream 20' X 5'; stream 10' X 5'. Abundance of kunkur limestone about.
		1 5 117	837.0	..	..	Stream 25' X 5'. Jungle. No cultivation.
		2 4 159	827.0	..	..	Sorigura. Small clearing in dense jungle. Dense forest of good timber trees; matti abundant; ample timber for railway sleepers. Virgin soil.
		4 1 0	..	..	..	Stream, Section 20. Virgin jungle and forest without a patch of clearing.
				..	..	Village of Padmara. Some dry cultivation. Flat country. Soil light sandy clay. Village of Pormalla.
				..	..	Irrigated land.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.				
		4 7 114	747-0	..	..	Village of Bakel. Wet and dry cultivation. Village of Olierka. Wet and dry cultivation. Soil dark clay.
		6 2 0	727-0	..	..	Village of Tolagaon. Wet and dry cultivation. Open ground round village. Scrub jungle.
		7 3 172	700-0	..	..	Village of Sorigura. Wet and dry cultivation near village.
		8 1 198	710-0	..	..	Village of Mandel. Ample cultivation all round. Black soil. Some jungle.
192 7 76	..	10 6 67	699-3	..	228	Village of Aswarg, situated in an old mud fort.
		0 1 94	..	..	..	Stream, Section No. 21. Light jungle and dry cultivation. Soil heavy clay, nearly black.
		0 7 194	699-0	..	..	Village of Bargaon. Open country. Extensive wet and dry cultivation.
		1 4 178	679-0	..	..	Good soil, nearly black.
		2 0 207	..	..	..	Villages of { Setirpalli } { Belpur }. Young mango trees about five years old. Extensive rice-fields.
		2 6 215	679-0	..	..	Tank. Jungle; a few patches of wet and dry cultivation. Much rock. Track branches off to Bunder.
		4 0 16	609-0	..	..	Stream 18' x 9'. Sandy bed; good banks.
		4 5 2	609-0	..	..	Village of Dowlat. Small village in jungle with little dry cultivation around.
		5 7 212	589-0	..	..	Village of Torla. Five huts in a clearing surrounded by jungle.
		6 7 28	549-0	..	..	Deron stream, Section No. 22.
		8 6 186	549-0	..	..	Village of Kendel. One dozen huts in a large clearing.
		9 5 3	..	..	..	..
		10 5 168	549-0	..	..	Village of Dammermurra. A few huts in a small clearing. Very little cultivation.
205 3 128	35 6 76	11 6 9	549-0	..	..	Stream 11' x 4'.
		12 4 53	627-7	..	71-6	Village of Begor. Small area of wet cultivation. Dry cultivation. Cross road from Bunder to Simbulpur.
		1 4 193	597-0	..	..	..
		1 7 93	547-0	..	..	Tel Nadi, Section No. 23.
		2 7 84	577-0	..	..	Village of Mohda.
		3 1 78	577-0	..	..	Soil heavy sandy clay. Wet and dry cultivation. Village of Gontaballi. Slightly undulating. Open park like country. Light scrub jungle and grass land.
		5 1 44	587-0	..	..	Village of Serko. Open country, high and dry ground. Light sandy soil.
		6 0 120	560-0	..	..	Stream, Section No. 24. Open grass country. Some cultivation. Village of Udupur.
		7 2 206	585-0	..	..	Village of Gurur. Wet and dry cultivation. Much garden cultivation.
		8 7 5	618-0	..	..	Village of Bholapader.
214 0 0	..	0 6 140	578-0	..	..	Stream, Section No. 25. Open country. Dry and wet cultivation. Extensive wet cultivation.
		2 7 116	578-0	..	..	Village of Kuland. Extensive cultivation, wet and dry. Some jungle. Undulating ground.
		4 2 171	618-0	..	..	Village of Gendargura. Rocky hillocks. Undulating country.
		6 2 144	568-0	..	..	Stream, Section No. 26. Village of Disten. Wet and dry cultivation. Soil dark clay.
		7 4 145	588-0	..	..	Village of Itchagao. Open flat country. Village of Perumara. Good camping ground. Flat open country, slightly undulating.
		9 3 48	508-0	..	..	Village of Badag. Wet and dry cultivation. Soil sandy clay.
224 1 0	..	11 6 200	633-0	..	..	Village of Baraman. Open country, well cultivated.
		1 6 11	633-0	..	..	Village of Bholapadma. Dark clayey soil. Well cultivated. Open country. Rock cropping up in places.
		3 7 125	623-0	..	..	Village of Salsarad. Extensive cultivation. Good camping ground.
		5 2 134	648-0	..	..	Village of Jhalp. Wet and dry cultivation. Top and garden cultivation. Soil gravelly. Top and garden cultivation. Quartz, out crops in several places.
		6 4 204	676-0	..	..	Village of Badar. Stream, Section No. 27. Good camping ground for an army.
234 2 0	..	10 0 135	686-0	48	..	Village of Folia. Swampy ground.
		1 0 183	686-0	..	..	Village of Riap. Wet and dry cultivation, scrub jungle, swampy ground; scrub jungle.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M. S. L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.				
		2 3 68	686-0	..	..	Village of Pokanor. Black soil. Wet and dry cultivation.
		3 5 160	666-0	..	..	Village of Bora Doil. Wet and dry cultivation. Rich dark clay.
		5 3 48	752-0	..	..	Village of San Doil. Large tank of drinking water. Scrub jungle. Good camping ground.
243 6 116	38 2 208	7 4 84	802-0	116	..	Village of Korial. Good camping ground. Low scrub jungle. No cultivation.
		2 0 73	772-0	..	..	Village of Chindagura. Extensive garden cultivation; some wet and dry cultivation.
		2 4 121	..	..	..	Heavy jungle.
		3 4 82	762-0	..	..	Village of Ponkpath. A little cultivation; heavy jungle.
		5 5 102	762-0	..	..	Heavy jungle. Garden cultivation; heavy jungle. Small stream 5' x 5'; stream 20' x 6'.
		7 1 23	730-0	..	..	Village of Nuapara. Wet cultivation. Jungle.
		8 0 192	711-0	..	..	Village of Bargaon. Light gravelly soil. Stream 15' x 6'; stream 10' x 4'; stream 10' x 4'.
255 5 153	..	10 5 66	741-0	..	..	Village of Kolinga. Jungle.
		11 7 37	761-0	..	41	Village of Tikali. A few huts in a clearing in the jungle. Hilly jungle. Stony soil with gravel; much quartz about.
		1 6 112	741-0	..	..	Stream, Section No. 28. Village of Lamipani. Wet and dry cultivation. Jungle with stunted teak.
		3 0 65	751-0	..	..	Stream 26' x 6'. Rock for foundations; ledges of stratified rock extending across the stream.
		4 4 128	751-0	..	..	Stream 6' x 4'. Jungle. Rocky and stony ground. Stream 10' x 5'.
		5 7 115	741-0	..	..	Village of Jalkusum. Rich dark soil. Stream 15' x 5'. Rocky bed; high banks.
		6 6 37	791-0	..	..	Stream, Section No. 29.
		7 5 75	811-0	..	..	Village of Dumaribahal. Wet and dry cultivation.
266 0 0	..	10 3 10	857-0	96	..	Village of Biliyar. Topes, gardens and fields.
		0 7 8	787-0	..	..	Village of Biliyar. Topes, gardens and fields. Wet and dry cultivation. Jungle. Hilly ground. Dense jungle. Fine camping ground.
		2 2 121	797-0	..	..	Village of Kumana.
		3 4 104	787-0	..	..	Gurmal stream, Section No. 30. Jungle. Dark rich soil. Open country. Grass land.
		4 5 171	797-0	..	..	Village-site of Gurur, deserted.
		5 3 84	707-0	..	..	Village of Kusima. Village of Takopara. Jungle and grass land. No cultivation.
		7 7 184	837-0	..	..	No track. Village of Kurisor. Some wet and dry cultivation.
		9 6 66	909-0	..	..	Rich dark soil. Stream, Section No. 31. Fine soil for wheat. Village of Koirbari. A little cultivation and some open ground. Dense jungle.
278 2 205	..	12 2 42	949-0	92	..	Village (deserted) of Jondramara. Good jungle all round.
		1 1 7	929-0	..	..	Village of Manikgura. A few huts in a small clearing in the jungle.
		4 0 183	929-0	..	..	Village of Turbor. Fields and gardens. Large tank. Rich dark soil.
		5 2 97	969-0	..	..	Stream 26' x 6'. Sandy bed. Jungle with little cultivation. Soil hard and gravelly. Track cleared through the jungle. Stream 12' x 3'; small stream 6' x 3'; small stream 6' x 3'.
		6 0 65	979-0	..	..	Stream, Section No. 32. Some sal here. Quartz. Light jungle with some patches of cultivation.
		8 4 113	1000-0	..	..	Stream 6' x 3'.
		9 6 65	1027-0	..	..	Village of Daldali. Some cotton and a good deal of rice.
		11 5 175	1047-0	98	..	Village of Nuapara. Large clearing. Hard soil. Wet and dry cultivation. Light jungle.
290 0 6	..	1 4 139	1047-0	..	..	Village of Kundamuri.
		3 0 218	1047-0	..	..	Village of Sambarsingi. Track branches off to Ternot.
		5 2 78	967-0	..	..	Village of Kajurkara. Undulating ground. Soil dark clay. Stream 10' x 4'; stream 12' x 5'.
		..	..	..	..	Village of Sialfori. Stream 8' x 3'. Light jungle.
		..	..	..	..	Open country.
		..	..	..	..	Village of Paratol. A tolerably large village.
		..	..	..	..	Jungle.
		..	..	..	..	High ground. Hard soil. Jungle. Trackless jungle. Hard soil. Stream 10' x 5'. Jungle.
		..	..	..	..	Village of Jalbat. Some garden cultivation. Wet and dry cultivation. Black soil north of village.
		..	..	..	..	Some open country. Stream 9' x 3'. Village of Kodumara. Open country. Good camping ground. Stream 12' x 5'.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.				
301 0 0	..	7 8 5	933-0	..	..	Village of Daripati. Open country. Some sal trees in jungle here. Soil brown sandy clay.
		9 3 147	983-0	..	..	Jungle. Fine level ground. Light jungle. Light soil.
		10 7 190	1013-0	..	34	Village of Birumal. Fine open camping ground. Not good water. Stream 15' x 6'. Swampy soil. Jungle. Village of Para.
		1 4 192	973-0	..	..	Village of Gyran. Large clearing. Light jungle. Dark clayey soil.
		2 4 6	975-0	..	..	Village of Bendabatta. Rich soil. Undulating ground. Large clearing and jungle alternating.
		3 4 0	..	..	..	Village of Barankela. Stream 10' x 4'. Extensive rice-fields. Undulating ground. Stream 20' x 5'.
		5 6 0	903-0	..	..	Village of Biana. Light jungle and scrub. Sal trees. Light sandy soil. Dense jungle. Many sal trees. Light jungle. Jungle.
		8 1 39	873-0	..	..	Light soil. Slightly undulating ground.
		9 0 210	840-0	..	..	Village of Belikiri. Open country around, about a mile in diameter.
312 3 0	..	11 0 23	840-0	..	..	Village of Balasur. Soil jungle. Quartz and bankur.
		12 3 138	918-0	..	56	Village of Anandi. Clearing in a sal jungle. Soil stiff clay.
		0 7 75	908-0	..	..	Stream, Section No. 33. Jungle.
		1 6 88	954-0	..	..	Village of Purada. Clearing in the jungle. Jungle. Stream 16' x 5'; stream 20' x 5'. Soil dark sandy clay.
		4 2 212	884-0	..	..	Village of Belanger.
		4 5 184	849-0	..	..	Stream, Section No. 34. Gram jungle. Hard soil and stony. Stream 6' x 3'. Black soil with cracks and holes. Stream 15' x 5'. Jungle.
320 2 0	76 4 74	..	899-0	..	..	Good tree jungle. Stream 15' x 5'. Soil stiff clay. Flat country.
		6 7 17	899-0	..	19	Village of Onki. A few miserable huts. Jungle all round.
		1 2 34	907-0	..	..	Village of Jalhal. Light jungle. Light clayey soil.
		2 1 108	947-0	..	..	Village of Saka. Open country. Little jungle. Wet and dry cultivation. Some laterite.
		2 6 71	907	..	..	Village of Chanabada. Gardens and fields.
		3 2 0	937	..	..	Stream, Section No. 34/5.
		3 4 149	977	..	..	Do. do. No. 34/5.
		4 4 16	967-0	..	..	Village of Amari. Wet and dry cultivation. Quartz reef running through small hill.
		5 4 109	967-0	..	..	Swampy ground.
304 3 0	..	6 6 22	967-0	..	..	Village of Kopathara. Garden and field cultivation.
		8 2 27	927-0	..	..	Village of Mograpali.
		9 0 53	1010-0	111 ft	..	Jong stream, Section No. 31/5.
		2 4 11	993-0	..	..	Village of Nara. Fine camping ground. Wet cultivation. Swamp. Stream 10' x 5'.
		4 1 153	970-0	..	..	Village of Tara. Wet cultivation. Light scrub jungle. Village of Lani.
		4 5 165	980-0	..	..	Kandajori stream. Section No. 35. Gneiss with quartz veins.
		5 7 94	990-0	..	..	And patches of feldspar. Village of Kamasas. Two large tanks. Wet cultivation. Stream 20' x 4'.
316 0 0	..	8 2 8	970-0	..	..	Village of Kulla. Much cultivation. Black soil. Jungle. Stream 5' x 3'.
		8 7 133	1033-0	..	..	Village of Puluari in a small clearing.
		10 6 57	1082-0	73	..	Village of Kophi.
		2 4 188	1083-0	..	..	Village of Loptakra. Wet cultivation. Jungle. Stream 12' x 4'. Irregular ground. Slightly hilly.
		3 7 90	1013-0	..	..	Jungle. Soil dark clay.
		5 6 79	983-0	..	..	Site of the deserted village of Padri. Dense jungle. Stream 25' x 5'. Sandy bed. Low banks. Undulating ground.
		6 6 293	950-0	..	..	Village of Patrapali. Stream 10' x 4'. Garden cultivation. Stream 10' x 4'. Stream 8' x 4'.
		7 5 125	1002-0	..	..	Stream, Section No. 36. Jungle. Stream, Section No. 37.
327 7 0	117	9 2 185	942-0	..	..	Fields and gardens near the village of Karibara. Stream 8' x 3'. Stream, Section No. 38. Site of deserted village of Durakabari.
		12 0 39	952-0	..	..	Scrub jungle. Swamp. Village of Karibara.
		12 6 294	1022-0	..	61	Extensive garden and field cultivation.
		1 1 33	982-0	..	..	Village of Telikanda. Extensive wet cultivation. Jungle.
				..	..	Undulating ground.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.				
339 6 0	..	2 6 30	962-0	..	..	Village of Manabamcha. Extensive cultivation. Swamp. Stream 10' x 4'. No cultivation.
		3 7 76	942-0	..	..	Site of deserted village of Patrapali.
		4 0 170	934-0	..	..	Sikli stream 25' x 8'. Sandy bed. Good banks.
		5 0 190	932-0	..	..	Dry cultivation. Stream 6' x 3'.
		6 3 58	902-0	..	..	Village of Arand. Soil black and full of holes.
		7 1 15	..	..	..	Dry cultivation.
		7 6 120	932-0	..	..	Village of Unarda.
		8 1 85	865-0	..	..	Stream 15' x 6'. Laterite rock for foundations.
		10 3 182	825-0	..	..	Soil light clay.
		11 6 124	915-0	..	107	Jungle. Stream 16' x 4'. Bed laterite and gravel.
		1 3 67	875-0	..	..	Jungle and swamp.
		3 5 48	865-0	..	..	Village of Patrapali. Stream 10' x 5'. Wet and dry cultivation. Stream 12' x 4'.
		5 7 184	810-0	..	..	Village of Pitajer. Good camping ground.
		6 4 201	..	..	..	Village of Mahasamund.
		7 0 4	935-0	..	..	Village of Khavara. Extensive cultivation, chiefly wet. No jungle. Good topes and trees. Tanks.
350 0 0	..	10 2 100	942-0	27	..	Village of Belara. Wet cultivation. Flat country.
		2 6 76	963-0	..	..	Village of Gwari. Mahanadi River.
		5 2 27	922-0	..	..	Village of Paragan. Soil clay. Stream 20' x 5'.
		7 2 02	923-0	..	..	High banks. Stony bed. Limestone.
		10 2 21	940-0	..	..	Town of Arang. Village of Bihir. Open flat country, well cultivated. Black soil.
363 4 0	..	13 4 10	969-7	27-7	..	Village of Rami. Tanks. Topes, sugarcane and rice-fields. Ground slightly undulating. Soil laterite. All cultivation.
		2 1 50	929-0	..	..	Kailhan stream, Section No. 40. Red soil. Wheat cultivation. All land under cultivation.
		3 5 185	900-0	..	..	Village of Nagagan. Extensive cultivation. Good camping ground. Light clay soil. Wells.
		5 0 97	942-0	..	..	Village of Hasand. All ground under cultivation, wet and dry.
		6 6 190	992-0	..	..	Village of Sirikheri.
371 5 211	76 7 193	8 1 30	962-0	..	7-7	Village of Jora. All land under cultivation, chiefly wet. Black soil.
				..	..	Village of Lathandah. Stream, Section No. 41.
				..	..	Black soil. Stream 15' x 6'. Black soil. Wheat and linseed.
				..	..	Village of Karamatoli. Tank. Topes of mbowa trees.
				..	..	Town of Raipur.

XXV.

STATEMENT of Particulars describing Mr. Nordmann's Route from Raipur (via Rajim, Naagarh, and Narangpur) to Kuraputi.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.				
			963.0			Camp at Raipur, near the Deputy Commissioner's Office. Town of Raipur. Outside the Cantonment.
		1 4 3	963.0			Irrigation channel. Limestone rock on surface. Good road.
		3 0 146	911.0			Village of Lalgaon; tank; soil laterite.
		5 0 187	911.0			Village of Deopary.
						Village of Dumurtalao; soil laterite; covered with brown clay; wet and dry cultivation; some waste land; dark clayey soil, full of cracks and fissures.
		6 4 135	941.0			
		8 2 4	941.0			
		10 0 75	971.0			Village of Mana; tank, topos, garden, and well; ironstone, gravel, and red sandstone.
						Nembhora talas; tank. Village half a mile distant.
		11 6 178	931.0			Ironstone, gravel, and red sandstone near village of Uparwara; tank, topos, garden, and well; fields of rice and wheat.
		13 5 17	951.0			Taivar stream 20' X 7'. Bed clay and gravel; banks well defined; laterite soil.
		14 2 137	1001.0	38		Chatoriah stream 15' X 5'. Bed laterite gravel; perpendicular banks.
						Khadwa village; topos, gardens, and tanks; soil laterite.
		1 1 130	989.0			Chitar stream 10' X 5'. Muddy bed; high banks; black soil.
		2 4 160	977.0			All cultivation; very little waste land; black soil; rice and wheat fields. Kolhan stream 20' X 10'; banks well defined; bed sand and gravel.
		3 4 95	989.0			Village of Thanoud to the right.
		5 3 154	971.0			Cross road going north and south. Red soil and laterite. Rice-fields.
		7 1 38	952.0			Village of Sunderkhara, with topos and tanks; extensive wet and dry fields; soil chocolate colored with small stones and gravel; sandy stone.
		8 5 180	946.0			Village of Parsada; a large village stream, Section No. 1; soil black; topos; much linseed cultivation.
		10 1 175	956.0			Village of Ghonth. Stream 15' X 10'. Steep banks; bed soft; soil black.
		10 6 35	914.0			Village of Paragaon, large village; groves of mango and tamarind trees; laterite rock.
		11 1 11	914.0			
		11 2 118	917.0			
25 5 0	11 2 118					Mahanadi River, Section No. 2.
		2 2 111	938.0			Village of Rajim. Mango topos; waste land; black soil; open country; topos and fields.
		4 2 117	928.0			Wheat, linseed, Bengal gram. Rice-fields; tank.
						Village of Chobabhandha; garden cultivation; wells; much wet cultivation; some waste land.
		6 2 12	908.0			Village of Sindhori.
		8 0 0	901.0			Village of Baronda; light soil; gardens wet and dry fields; sugar-cane, castor oil; red gravelly soil; stream, Section No. 3; black soil. Village of Chichedh.
		10 1 206	931.0	14		Village of Kuraskera; tope and large gardens; light soil.
						Village of Tara; gardens, topos, and small tanks; light soil; mango tope; plantation of young mango trees.
		1 3 85	899.0			Village of Kopa; tanks, topos, and gardens; black soil; dry crops; castor-oil trees and linseed, some waste land. Stream 10' X 8'; high banks; soft bed.
		2 4 25	899.0			
		4 1 73	915.0			Village of Surkunda; gardens and wells; sugar-cane, plantains, castor-oil, chillies, brinjals; tank; black soil; jungle. Village of Panduka; Police Station; tank.
		6 3 62	899.0			Village of Kutna; light jungle; sandstone rock cropping out. Jungle stream 9' X 4'; good banks; hard bed; much sandstone rock about.
						Light soil; sugar-cane plantation. Stream 25' X 8'; good banks; hard bed; jungle, with some cultivation. Rice-fields.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.	FEET.	FEET.	FEET.	
		6 4 70	923.0			Village of Kukda. Jungle all round; sandstone and gneiss and some laterite. Rice-fields in jungle. Light clayey soil; scrub jungle.
		7 7 130	915.0			Gneiss rock; dense jungle; swampy soil; rudely cultivated soil alternately stony and swampy; stream 12' X 5'; steep banks; soft bed; stream 7' X 4'.
		9 0 0				Stream 9' X 4'.
		9 1 160				Stream 12' X 5'.
		9 2 0				Deserted village of Pahpur.
		9 3 25				Stream 9' X 4'. Stream 9' X 4'; broken ground; dense jungle and high grass; hill side cutting required; all rocky hill side; cutting required.
		9 4 0	939.0			Stream 25' X 6'; sandy bed.
		10 6 145				Village of Bourka, a small village in a jungle clearing. Hilly jungle. Rice cultivation in a swamp. Low hill ridges on both sides; soil hard and gravelly; Kankur limestone, gneiss, and conglomerate rock.
47 7 21	12 0 0	12 0 0	992.0	61		Jungle; light soil; some rock.
		1 5 98	978.0			Stream 10' X 4'. Low banks; sandy bed.
		2 1 0				Stream 10' X 4'.
		2 4 0				Do. 10' X 4'.
		3 5 37	964.0			A large clearing in the jungle. Village of Karti on opposite side of river. Village of Kurubata; tank; extensive rice-fields.
		4 4 150				Village of Malas on the hill side.
		5 0 144				Pairi River, Section No. 4. Country largely cleared. Rice, Bengal gram, sugarcane, linseed, castor-oil trees, tobacco, and wheat.
		5 2 214	1005.0			Small tank, black soil. Village of Manjarkata; ground recently cleared and cultivated; sheet rock, gneiss.
		6 1 0	978.0			Village of Andi; some cultivation; thin jungle.
		7 1 107	1006.0			Flat country.
		7 6 142				Stream 13' X 5'. Stream, Section No. 5. Village of Paraga; good gardens; an avenue of young mango trees.
		8 5 0				Sheet rock; gneiss; stream 25' X 4'.
57 2 126	9 3 105	9 3 105	1130.0	138		Deserted village of Dongriga. Stream, Section No. 6. Soil alternately swampy and stony; ground level with slight undulations. Dense small jungle; stream 12' X 3'.
		1 3 146	1119.0			Tirnai stream, Section No. 7; gneiss and quartz rock.
		1 7 0				Soil alternately hard and gravelly; stream 9' X 3'; sandy loam; tall young timber; undulating ground.
		2 6 54	1163.0			Bugal stream, Section No. 8. Rising ground; stony soil; drainage channel 6' X 4' all jungle; hard soil; tall grass; several small drainage channels.
		4 1 40	1207.0			Korihadi stream, 25' X 3'. Sandy bed; hard soil; tall jungle with undergrowth; high grass; hard gravelly soil; undulating ground; hill side cutting required; good matti timber abundant. Moga stream, 15' X 4'.
		5 5 187	1330.0			Head of Urtuli Ghat; hilly jungle and stony, irregular ground; ground flat again, only gently undulating. Some grassy plots in jungle (the road need not come so high up; this summit can be circumvented).
		7 4 92	1303.0			Patches of grass and swamps; deserted village of Jaba; stream 5' X 3'; black soil; stream 6' X 4'; stony soil.
		9 1 472	1324.0			All jungle; some broken and irregular ground and stony; much young sal wood.
		10 1 152	1240.0			Teregi stream, 15' X 9'; all sal jungle; some matti trees.
		11 2 170	1264.0			Kozani stream, 20' X 4'; rock for foundations; undulating ground; good hard soil.
		12 5 110				Harpali stream, 25' X 7'; sandy bed; steep banks.
70 3 154	13 1 28	13 1 28	1314.0	184		Village of Naagarh. Jungle irregular ground; light sandy soil, occasionally rocky.
		1 2 165	1324.0			Summit level of rise.
		1 4 0				Some hill side cutting required. Murgi stream, 15' X 4'; high grass; much young sal.

Statement of Particulars describing Mr. Nordmann's Route, &c.—*cont.*

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		2 1 163	1294-0	..	..	Teregi stream, 15' X 7'. Abundance of quartz, pink and red.
		2 6 8	1294-0	..	..	Bardul, a clear spot in the jungle. Ground flat and somewhat swampy.
		3 5 12	1274-0	..	..	Satigat stream, Section No. 9. Soil light sandy loam; ground nearly flat; slight undulations.
		4 2 190	..	..	..	Area of deserted fields.
		4 4 0	..	..	..	Kusmi stream, Section No. 10. A temple, but surrounded with palisades.
		5 0 70	..	..	..	Village of Kusmi, a large clearing with extensive rice-fields. Rich soil.
		5 4 0	..	..	..	Jungle. Young sal; gneiss rock.
		6 4 0	..	..	..	Stream 8' X 4'.
		6 6 0	..	..	..	Do. 8' X 2'.
		7 5 3	1294-0	..	..	Village of Boirga, small village fenced in, soil good; swamp; black soil. Jungle; Sal forest 10 to 15 years old. Tall grass.
		9 2 0	1234-0	..	..	Kolbora stream, 15' X 4'. Gneiss rock for foundation. Jungle.
		9 5 20	..	..	..	Budra stream, Section No. 11. Grass 7' to 10' high.
81 2 65	10 6 131	10 4 40	1295-0	..	..	Amajori Stream, 25' X 5'. Sandy bed; no rock.
		10 6 131	1295-0	..	..	Village of Baltema, 8 huts in a wilderness.
		..	..	..	..	Low scrub jungle with young sal and tall grass.
		0 4 0	..	..	..	Rich dark soil.
		1 2 30	1295-0	..	..	Village of Pandra partly deserted. Soil reddish sandy loam.
		1 6 0	..	..	..	Uneven ground. Stream 10' X 4'.
		2 2 12	1335-0	..	..	Village of Pandra, in a new clearing.
		2 4 0	..	..	..	Maria stream, 10' X 3'. Uneven and broken ground; much quartz about.
		2 6 0	..	..	..	Parapani stream, 15' X 4'.
		3 0 70	..	..	..	Jamun stream, 9' X 3'.
		3 5 42	1275-0	..	..	Pulbhari stream, 25' X 4'. Some rock for foundations; sandy bed; good banks.
		3 7 0	..	..	..	Sarai stream, 12' X 4'. Sal jungle; tall grass.
		4 2 50	..	..	..	Tari stream, 20' X 5'. Rocky bed; steep banks.
		4 3 0	..	..	..	Ground uneven, hard and stony.
		1 5 18	..	..	..	A hill of quartz.
		4 7 0	..	..	..	Chicklasi stream, 15' X 3'. Rocky bed; pink quartz; gneiss and conglomerate.
		5 2 40	1285-0	..	..	Deserted village of Gobra.
		5 3 0	..	..	..	Quartzose gneiss and conglomerate.
		5 7 205	1285-0	..	..	Gogor stream, Section No. 12. Good bridge; site solid rock on both sides. Wild jungle and tall coarse grass.
		6 5 50	..	..	..	Deserted village of Katipara. Flat country; marshy glade jungle.
		7 4 0	..	..	..	Sheet rock, gneiss. Fine young forest, chiefly sal.
		8 3 110	1335	..	..	Burpani Stream, 10' X 4'. Stream 7' X 3'.
		9 0 0	..	..	..	Wild jungle and tall grass.
		10 3 170	1390-0	..	..	Stream 5' X 3'. Flat ground; some swampy.
		10 6 0	..	..	..	Mura Cora Stream, 10' X 4'. Fine young sal forest; stately forest; sal and matti.
93 2 135	12 0 70	12 0 70	1441-0	..	..	Junction of Dhour and Sendor Rivers. Dhour River, Section No. 13.
		0 5 22	1441-0	146	..	Village of Tenuai; 3 or 4 huts in a jungle clearing; abandoned rice-fields; black soil; swampy.
		1 0 0	..	..	..	Village of Tumaribahal; all jungle.
		..	..	..	..	Deserted village of Madibahal; some ploughed fields.
		..	..	..	..	Ground flat; soil light and soft sandy clay; clearings and grass plots in the jungle. Jungle light; drainage channel, 5' X 3'; small swamp.
		2 4 152	1441-0	..	..	Village of Kasror; 4 huts, 20 people; hills to the left; one point marked 2,445' on map.
		3 0 100	..	..	..	Kamankor stream, 15' X 4'. Soft bed; steep banks.
		3 2 70	..	..	..	Tall rank grass; forest of sal; ground slightly undulating. Kamribaha stream, 15' X 5'.
		4 0 194	1431-0	..	..	Soil light sandy clay.
		4 4 100	..	..	..	Tel Dhorai stream, 20' X 5'. Steep banks; gravelly bed.
		..	..	..	..	Village of Borpoder; 15 huts, 60 people; rice-fields; gardens. Katasara stream, 25' X 5'; converted into rice-fields.

Statement of Particulars describing Mr. Nordmann's Route, &c.—*cont.*

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		5 2 62	1441-0	..	..	Kunnar stream, 20' X 5'. Rocky bed; some undulating ground.
		5 7 0	..	..	..	Jhurra stream, 15' X 5'. Young sal jungle; undulating ground.
		6 5 210	1471-0	..	..	Kaser stream, 12' X 5'. Stream 5' X 3'.
		7 0 0	..	..	..	Urni stream, 8' X 3'. Steep undulating ground.
		7 3 146	1482-0	..	..	Lafni stream, 13' X 5'. Rocky bed; much quartz in small fragments on the surface.
		7 7 0	..	..	..	Kissi stream, 15' X 4'.
		8 3 100	1514-0	..	..	Village of Karki; 5 huts with 25 people.
		8 6 48	..	..	..	Bag stream, Section No. 14.
104 0 85	10 5 170	10 5 170	1569-0	128	..	Village of Risgaon; 15 huts, 60 people; tamarind tops for camping; fields and gardens. Stream 20' X 5' in swamp; light jungle; some swampy ground.
		0 6 180	1585-0	..	..	Deserted village of Kursudi. Sal jungle with grassy glades.
		2 3 205	1647-0	..	..	Jungle; slightly undulating ground; fine tall jungle and forest trees.
		3 5 117	1634-0	..	..	Pandriani stream, 10' X 4'.
		3 6 150	..	..	..	Seroa River, Section No. 15.
		4 0 170	1647-0	..	..	Deserted village of Gourgau. Soil rich clay.
		4 4 145	..	..	..	Country flat; hills in front and to right. Stream 15' X 5'; clayey soil; low scrub jungle and coarse grass.
		5 1 20	1647-0	..	..	Forest; some large teak; irregular ground, undulating; sal jungle; ground flat; good soil; jungle.
		7 0 0	1777-0	..	..	Enter Jeypur territory. Ground flat; forest of sal and teak.
		7 4 0	..	..	..	Small drainage to the left 3' X 3'; swamp with black soil.
112 7 165	8 7 80	8 7 80	1870-0	301	..	Village of Hathgaon. Swamp and rice-fields; tall grass and jungle.
		0 7 85	1910-0	..	..	Sal jungle.
		..	..	..	..	(This rise can be circumvented by tracing along the banks of the Golaria stream, about a mile to the east.)
		1 4 109	2010-0	..	..	Kuradadodi stream, 10' X 3'. Road branches off to Kotasapur; rock about.
		2 0 57	2020-0	..	..	Jungle of tall matti and sal.
		3 2 28	1970-0	..	..	Golaria stream, 25' X 5'. Swampy glade; swampy glade; dense young sal jungle.
		7 5 40	1960-0	..	..	Here begins the Jeypur plateau.
		5 4 0	2090-0	..	..	Large clearing near Kurabers; swamp and rice-fields. The campaign country of Jeypur.
		5 9 100	2090-0	..	..	Village of Koliapoder; low scrub jungle; soil dark clay.
		7 2 0	2090-0	..	..	Jungle; young sal; flat country; swamp and jungle; soil less dark and heavy.
		8 6 80	2070-0	..	..	Village of Raigarh; 40 houses, 150 people; swamp jungle; soil hard brown loam; laterite and gneiss.
124 0 45	11 0 100	11 0 100	2101-0	231	..	Cultivated land; swamp; jungle swamp partly cultivated.
		1 7 125	2055-0	..	..	Deserted village of Kuruli. Large cultivated swamp; jungle sal and scrub; fine forest; matti, sal, blackwood.
		3 2 22	2065-0	..	..	Small glade; fine forest; soil rich clay.
		5 2 165	2055-0	..	..	Ground gently undulating; primeval forest.
		6 0 0	..	..	..	Soil light brown sandy clay.
		7 5 35	1924-0	..	..	Sal jungle; soil sandy loam.
		9 4 84	1942-0	..	..	Small jungle; small jungle.
		10 4 40	..	..	..	..
		10 5 0	1977-0	..	..	A ledge of gneiss rock cropping out.
		11 4 43	1967-0	..	..	Village of Bera; 15 huts, 40 people.
135 4 88	11 4 43	11 4 43	1977-0	..	..	Tel Nadi, Section No. 16. Jungle and high grass.
		0 5 0	1977-0	..	..	..
		0 6 0	..	..	..	Primeval forest; ground slightly undulating.
		2 2 140	1997-0	..	..	Glade.
		2 1 40	2017-0	..	..	Village of Burja, 50 houses, 150 people.
		3 5 0	..	..	..	Poragada hills to the south; swamp.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.	FEET.	FEET.	FEET.	
		4 0 0	2010.0	..	..	Scrub jungle; good soil; fields and light jungle. Clearing and swamp; light jungle; swamp cultivated.
		5 3 0	2000.0	..	..	Bhaskol Nulbah, Section No. 17.
143 0 186	7 4 98	7 4 98	2021.0	54	..	Village of Omorkot. Jungle; sal.
		1 3 178	2011.0	..	..	Jungle; some rock; light sandy loam.
		2 0 0	1971.0	..	..	Village of Dongrigura.
		3 3 190	1971.0	..	..	Swamp with some cultivation; rich dark soil.
		4 0 175	1971.0	..	..	Village of Sana Borondi. Large gardens; swamp; young mango tops.
		5 1 64	1971.0	..	..	Village of Boro Borondi.
		8 5 124	1911.0	..	..	Large gardens.
		7 0 150	1961.0	..	..	Nagi River, Section No. 18 (reading taken in bed of stream); laterite cropping out.
		9 4 71	1911.0	..	..	Village of Dedra. Extensive rice-fields; light jungle; a tank with some rice-fields; light jungle and clearings alternately.
		11 6 0	1931.0	..	..	Village of Tetargan. Swamp; gently undulating ground; scrub jungle; small sal jungle.
155 5 2	12 4 36	11 7 200	1955.0	..	..	Village of Chaugura.
		12 4 36	1955.0	..	..	Chatringi River, Section No. 19.
		1 4 15	1935.0	..	..	Village of Bijapur. Sal jungle; soil stiff clay; sal jungle.
		2 2 2	1925.0	..	..	Soil sandy.
		4 2 20	1896.0	..	..	Large swamp, partly banded up; village of Nakjor.
		6 2 175	1875.0	..	..	Swamp; stream 9' X 4'.
		6 2 206	1845.0	..	..	Small sal jungle.
		7 4 65	1923.0	..	..	Befri stream, Section No. 20 (reading taken in the bed of the stream).
		8 7 176	1963.0	..	..	Jungle cleared 20 feet wide for the road; fine sal forest; undulating ground. Stream 9' X 3'; swamp.
165 3 71	10 6 69	10 3 69	1983.0	23	..	Black soil; jungle; soil sandy loam; swamp.
		0 3 106	1983.0	..	..	Village of Dabgan. Fine camping grounds.
		2 0 94	1983.0	..	..	Ongi stream, Section No. 21; jungle.
		3 0 0	1973.0	..	..	Village of Moideri. Undulating ground; swamp; fine sal forest.
		4 1 117	1973.0	..	..	Drain 5' X 3'.
		5 2 23	1953.0	..	..	Jungle; swamp.
		6 6 130	1913.0	..	..	Undulating ground; jungle; sandy soil.
		7 1 43	1893.0	..	..	Village of Barigura.
		9 4 155	1953	..	..	Village of Jambahal. Swamp.
177 3 137	11 0 66	10 6 0	1902.0	..	..	Basni stream, Section No. 22. Swamp; small sal jungle; sandy soil.
		11 0 66	1922.0	..	..	Summit of rising ground; small sal jungle; swamp.
		1 1 59	1972.0	..	..	Turi stream, Section No. 23.
		2 6 4	1892.0	..	..	Village of Paparhandi; 100 houses, 400 people; old mud fort and stone temple; good camping ground.
		3 0 32	1870.0	..	..	Fine tree jungle and swamp; rising ground.
		4 1 19	1944.0	..	..	Red soil; swamp; stream 10' X 5'; scrub jungle.
		6 0 18	1912.0	..	..	Swamp cultivated.
185 4 110	8 0 193	6 0 193	1918.0	..	..	Gantat River, Section No. 24.
		1 3 202	1864.0	..	..	Top of rise; scrub jungle; swamp; swamp.
		1 5 63	1864.0	..	..	Fine mango tops; avenue for two miles; laterite rock; mango tops; avenue.
		3 0 81	1864.0	..	..	Village of Narangpur; 600 houses, 4,000 people; Village of Narangpur; town of Narangpur; extensive rice-fields; mango tops. Village of Bara-bukli; stream 25' X 3'; muddy banks and bed.
		3 5 81	1918.0	..	..	Soil red; some laterite.
		4 0 94	1882.0	..	..	Indrabati River, Section No. 25. Some light jungle; dry crops, Bengal gram, dhol, and tobacco; rice-fields.
		4 6 84	1882.0	..	..	Enter jungle; rising ground; some laterite gravel.
		5 3 146	1936.0	..	..	Summit of rise.
				..	..	Foot of slope.
				..	..	Jungle.
				..	..	Summit of ascent soil red gravel.

Statement of Particulars describing Mr. Nordmann's Route, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.	FEET.	FEET.	FEET.	
		6 0 0	1927.0	..	..	Small jungle.
		7 6 187	1927.0	..	..	Stream 7' X 3'; swamp; jungle.
		7 7 95	1882.0	..	..	On shoulder of big hill; soil brown clay; light jungle.
194 1 210	8 5 100	8 5 100	1873.0	..	45	Paddy flat; village of Porli; 30 houses, 120 people.
		1 2 172	1913.0	..	..	Camp at Porli; cultivated swamp; stream 30' X 10'; steep soft banks; soil sandy loam.
		2 2 138	1913.0	..	..	Undulating ground; long glade to the left; fine mango tops; topos, fields, and swamps.
		3 1 70	1963.0	..	..	Soil clay; rice-fields.
		4 0 73	1953.0	..	..	Swamp cultivated.
		4 6 136	1953	..	..	Village of Boriguma; 100 houses; bungalow of mud and thatch.
		5 6 147	1983.0	..	..	Near the village of Dullaguda; swamp and jungle; heavy clayey soil.
202 7 208	8 5 218	8 5 218	1981.0	103	..	Undulating country; mango topos; rice-fields; swamp.
		7 1 100	1982.0	..	..	Hilly country with swamp; rice-fields.
		1 0 80	2042.0	..	..	Camp near the village of Pupegaon; light jungle; soil stiff brown clay.
		2 6 20	1971.0	..	..	Summit of ascent; light jungle with patches of cultivation; soil stiff clay. Village of Kumar-put, swamp made into fields. Village of Kebbedy.
		4 3 30	2017.0	..	..	Telingiri River; Section No. 26; near Cheptaamb, site of former village. Stream, rice-fields on sloping ground; rain-fed; many mhowa trees.
		6 1 200	2037.0	..	..	Village of Boriput; dry cultivation.
210 0 72	7 0 84	7 0 84	2017.0	36	..	Soil dark brown clay; hills on both sides; irregular ground; rocky; road is on hill side; cutting alongside Telingiri River.
		1 0 200	2094.0	..	..	Stream 15' X 6'; hilly jungle on the banks of the Telingiri River.
		1 7 125	2061.0	..	..	Village of Hanigar; five huts. Telingiri River; hill stream 10' X 4'; hill side road; jungle; some clearing; hard rocky soil.
		2 4 0	2105.0	..	..	Bifurcation of roads to Madeoputi and Kuraputi; uneven ground; some cutting and embanking required; stream 12' X 4'; soil soft clay; some rock.
		2 4 207	2105.0	..	..	All hill side cutting; stony hill side; hard soil; good jungle; fine sal and matti trees.
		2 6 173	2105.0	..	..	Stream 12' X 4'. Stony bed and banks.
		4 2 150	2160.0	..	..	On river bank, Section No. 27.
		5 4 40	2314.0	..	..	Young mango tops; fields; village of Musaput; stony stream 12' X 4'. The hill side partly cultivated, chiefly with castor-oil trees.
		5 7 100	2380.0	..	..	Stream 12' X 4'.
		6 6 25	2457.0	..	..	Village of Bandakatra; ten houses with gardens; stream 15' X 4'; stony soil; stony and swampy stream.
		7 4 180	2457.0	..	..	Mango tops; broad flat saddle.
		8 6 108	2479.0	..	..	Village of Panasput. Tank for drinking water; soil red gravel; stony stream; fine mango trees.
220 0 27	9 7 175	9 7 175	2520.0	503	..	Soil red sandy loam; small mango grove. Plateau.
223 4 27	3 4 0	3 4 0	2900.0	380	..	Village of Madeoputi; thirty houses; tamarind and mango topos; no jungle; much dry cultivation.
				..	..	Village of Muchra. Stream 20' X 5'; soil yellow clay with sand; stream 12' X 4'.
				..	..	Village of Mastiput.
				..	..	Village of Kuraputi.

XXVI.

STATEMENT of particulars describing Mr. Nordmann's route from Mastiput across the Jeypur plateau and down the Eastern Ghats to Sâler.

Statement of particulars describing Mr. Nordmann's route, &c.—*cont.*

Statement of particulars describing Mr. Nordmann's route, &c.—*cont.*

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	FEET.	
	15 0 0	3,250-0	..	..	..	(a) Meriapad saddle (gradient 1 in 76).
33 0 0	29 0 0	2,213-0	..	1,037	..	Pachipenta saddle (1 in 50).
	33 0 0	770-0	..	1,443	..	Foot of hills (1 in 103).
		569-0	..	201	..	Salar.
	2 4 0	3,250-0	..	..	..	(b) Meriapad saddle (1 in 92).
	9 6 0	3,107-0	..	..	..	Meriapad cutting.
	12 2 0	2,600-0	..	650	..	Lavady saddle (1 in 125).
	17 6 0	2,494-0	..	..	..	High Sankipenta (1 in 100).
35 6 0	31 6 0	2,213-0	..	387	..	Pachipenta saddle (1 in 50).
	35 6 0	770-0	..	..	..	Foot of the hills (1 in 103).
		569-0	..	1,644	..	Salar.
	2 4 0	3,250-0	..	..	..	(c) Meriapad saddle (1 in 92).
	9 6 0	3,107-0	..	..	..	Meriapad cutting.
	15 2 0	2,600-0	..	650	..	Lavady saddle (1 in 75).
33 2 0	29 2 0	2,213-0	..	387	..	Pachipenta saddle (1 in 50).
	33 2 0	770-0	..	..	..	Foot of hills (1 in 103).
		569-0	..	1,644	..	Salar.
	2 4 0	3,250-0	..	..	..	(d) Meriapad saddle (1 in 92).
	9 6 0	3,107-0	..	..	..	Meriapad cutting (1 in 50).
	16 4 0	1,622-0	..	..	..	Wondranghy stream.
29 2 66	17 1 66	1,622-0	..	1,628	..	Rodavalsa tunnel (1 in 50).
	25 2 66	770-0	..	..	..	Foot of hills (1 in 106).
	29 2 66	569-0	..	1,053	..	Salar.
	2 4 0	3,250-0	..	..	..	(e) Meriapad saddle (1 in 92).
	12 4 0	3,107-0	..	..	..	Meriapad cutting (1 in 35).
	13 1 67	1,622-0	..	..	..	Wondranghy stream.
23 0 67	19 0 67	770-0	..	..	..	Rodavalsa tunnel (1 in 35).
	23 0 67	569-0	..	2,681	..	Foot of the hills (1 in 105).
			..	..	..	Salar.
	1 0 200	2,017-0	..	..	..	(f) Ranigar.
	1 7 125	2,094-0	..	..	..	..
	2 4 207	2,061-0	..	..	..	..
	4 2 150	2,105-0	..	..	..	..
	5 4 40	2,180-0	..	..	..	..
	6 6 25	2,314-0	..	..	..	..
	7 4 180	2,457-0	..	..	..	..
	8 6 108	2,457-0	..	..	..	..
	9 7 175	2,479-0	..	..	..	..
	11 1 27	2,520-0	503	..	..	Mastiput.
	12 4 175	2,560-0	..	..	..	..
	13 6 7	2,670-0	..	..	..	..
	15 0 31	2,680-0	360	..	..	Lanka saddle.
17 7 98	16 6 150	2,830-0	..	..	..	..
	17 7 98	2,750-0	..	..	..	..
		2,779-0	..	..	..	Near Chikapur bridge.
			..	101	..	..

XXVII.

STATEMENT of particulars describing Mr. Cormac's route from Comellyphettah (*via* Singapore) to Lonjiger.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
			703-0	..	..	Village of Comellyphettah.
			..	..	..	Stream 50' x 9'.
		1 2 140	703-0	..	..	..
		1 6 36	..	..	..	Stream 30' x 10'. Sandy bed, banks well defined, country broken by ravines, low jungle.
		2 1 35	703-0	..	..	..
			..	..	..	Stream 30' x 10'. Sandy bed, banks well defined, country broken by ravines, low jungle.
		2 7 108	723-0	..	..	Dry cultivation.
		3 6 116	733-0	..	..	Wet and dry cultivation.
		5 0 180	803-0	..	..	Ground well cultivated, generally dry.
		5 8 167	..	..	..	Stream 40' x 6'. Sandy bed, banks not well defined.
		6 0 142	845-0	..	..	..
			..	..	..	Ground highly cultivated and irrigated by channels.
	7 0 120	7 0 120	835-0	132	..	Village of Dorabada, extensive area of wet cultivation to east. Stream 6' x 4'.
		0 4 115	835-0	..	..	..
		0 7 10	..	..	..	Stream 20' x 6'. Sandy bed, banks not well defined.
		1 1 201	..	..	..	Ground highly cultivated, generally dry. Village of Rampocum.
		2 0 68	817-0	..	..	Stream 15' x 4'.
		2 2 5	..	..	..	Side lying ground, highly cultivated, partly irrigated.
		2 7 108	859-0	..	..	Stream 40' x 8', at bottom of ravine. Sandy bed, banks not well defined.
		3 0 112	825-0	..	..	..
		3 1 121	869-0	..	..	Dry cultivation to east.
		..	..	..	..	..
		4 1 96	855-0	..	..	Dry cultivation to east.
		5 3 58	922-0	..	..	Saddle. Small hills on each side.
			..	..	..	Jungle village of Bejjah.
			..	..	..	Bellacondah.
		6 1 38	904-0	..	..	..
		6 2 23	854-0	..	..	Stream 20' x 3'.
		6 2 90	833-0	..	..	..
		7 0 74	932-0	..	..	Stream 12' x 6'.
		7 1 15	874-0	..	..	..
		7 2 147	932-0	..	..	Stream 15' x 3'.
		7 4 192	932-0	..	..	Dry cultivation, village of Dammanjumah.
		7 5 130	903-0	..	..	..
		7 6 144	932-0	..	..	..
		8 4 52	982-0	..	..	Village of Shikarpay away to the left.
		9 0 53	992-0	..	..	Camp near Shikarpay.
	9 1 47	9 1 47	992-0	157	..	Stream 18' x 8'. Sandy bed.
		0 1 110	..	..	..	Village of Davalsaddy.
		0 3 0	..	..	..	Stream 15' x 6'.
		0 4 68	..	..	..	Stream 20' x 8'. Rocky bed.
		0 7 196	952-0	..	..	Village of Boodagoodah. Nagavully river parallel to road, whole width of valley cultivated.
		1 1 125	..	..	..	Stream 20' x 6'. Shingly bed. Valley about 24 miles broad. Wholly cultivated, all dry.
		2 2 175	992-0	..	..	..
		2 5 110	..	..	..	Stream 30' x 6'. Sandy bed, extensive wet cultivation, land irrigated.
		3 2 24	982-0	..	..	Temple at Narainpoorum.
		4 0 50	1,015-0	..	..	Stream 40' x 10'.
		4 1 186	972-0	..	..	..
		4 2 148	1,010-0	..	..	Village of Kosagoodah; castor-oil, hemp, linseed, gram.
		..	..	..	..	..
		6 0 80	1,012-0	..	..	Stream 50' x 8'. Rocky bed.
		5 1 155	982-0	..	..	..
		5 2 160	1,012-0	..	..	Camp near Singapore. Small town of Singapore.
		6 2 32	997-0	..	..	..
		7 0 80	957-0	..	..	Nagavully river, banks not well defined, 3 spans required, 40' x 18'.
		7 0 185	992-0	..	..	..
	7 2 25	7 2 25	997	5	..	Town of Singapore, on left bank of Nagavully river, dry cultivation.
		1 0 63	1,047-0	..	..	Dry cultivation, jungle recently cleared.
		2 0 0	1,057-0	..	..	Do do.
		2 3 10	..	..	..	Dry cultivation.

Statement of particulars describing Mr. Cormac's route from Comellyphettah, &c.—*cont.*

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		2 7 165	1,067-0	..	..	Dry cultivation to west, jungle to east. Recently cleared.
		3 7 145	1,077-0	..	..	Sál forest.
		..	1,158-0	..	..	Bondesor and Lonjigar roads diverge from this point.
		4 3 190	1,097-0	..	..	Palkonlanah.
		4 4 160	1,037-0	..	..	Stream 80' X 12'. Sandy bed, banks not well defined.
		4 5 150	1,097-0	..	..	Jungle.
		5 1 96	..	..	..	Palkonlanah; extensive area under cultivation near village.
		5 2 90	1,097-0	..	..	Stream 80' X 10'. Rocky bed, banks not well defined.
		5 3 5	1,037-0	..	..	Stream 20' X 6'. Jungle.
		5 4 0	1,097-0	..	..	Dry cultivation in patches here and there.
		5 6 60	..	..	..	Stream 20' X 6'. Stony bed.
		6 1 12	1,147-0	..	..	Dense jungle.
		6 6 150	1,167-0	..	..	Fine forest.
		6 6 210	1,275-0	..	..	Stream 30' X 8'. Rocky bed, banks not well defined, dense jungle.
		7 2 30	1,275-0	..	..	Stream 30' X 8'. Rocky bed.
		7 5 90	1,295-0	..	..	Do. 15' X 6'.
		8 1 60	1,356-0	..	..	Do. 20' X 8'.
		8 6 150	1,515-0	..	..	Dry cultivation.
		9 7 145	1,515	..	..	Village of Tirmui. Dense jungle.
		10 0 10	1,565	..	..	Much large sál, yegi, and matti.
		10 3 35	1,602-0	..	..	Fine forest.
		10 5 115	1,592-0	..	..	Forest.
		1 0 20	1,597-0	..	..	Small patch of cultivated ground. Forest.
		2 0 0	1,597-0	..	..	Village of Narraindrang. Large area cultivated round village, principally sugar-cane.
		3 0 10	1,627-0	..	..	Wet cultivation, some topes of mango trees.
		3 5 190	..	..	..	Stream 40' X 12'. Bondesara river, banks well defined, bed stony.
		4 4 70	1,452-0	..	..	Camp near the town of Lonjigar.
		5 6 68	1,386-0	..	..	
	6 1 190	6 1 190	1,396-0	..	206	

XXVIII.

STATEMENT of particulars describing Mr. Cormac's route from Palkonlanah (near Singapore) *via* Músa Ghát to Bogor.

Distance from Vizagapatam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		..	1,158-0	..	..	Near the village of Palkonlanah.
		0 5 0	1,208-0	..	..	Jungle.
		1 1 115	1,208-0	..	..	Village of Chothopoor. Jungle.
		1 4 0	1,168-0	..	..	Dry cultivation.
		1 4 150	1,158-0	..	..	Patches of wet cultivation.
		1 5 100	1,198-0	..	..	Village of Moondeegoodah.
		2 3 25	1,208-0	..	..	San river 60' X 10', banks well defined, bed sandy.
		2 4 0	..	..	..	Wet cultivation to east, hills on west.
		2 4 110	1,198-0	..	..	Ghat commences.
		2 5 145	1,228-0	..	..	First saddle.
		3 4 0	1,238-0	..	..	Skirting hill side.
		3 7 0	1,338-0	..	..	Second saddle.
		4 2 90	1,368-0	..	..	Mango tops.
		4 5 25	1,468-0	..	..	Village of Bijepur. Several acres of dry cultivation near village.
		5 0 30	..	..	..	Small stream 15' X 8'. Rocky bed.
		5 1 0	..	..	..	Village of Koramunda: extensive area of dry cultivation near village.
		5 3 140	1,478-0	..	..	Low jungle; patches of cultivation.
		6 0 175	1,478-0	..	..	Jungle, gravelly soil.
		6 1 160	..	..	..	Stream 20' X 6'. Bed gravel.
		6 5 10	..	..	..	Camp near Kundru.
		7 0 100	1,528-0	..	..	Stream 12' X 8'.
		7 4 150	1,588-0	..	..	Jungle.
		8 6 55	1,688-0	..	..	Head of Músa Ghát.
		9 2 85	1,708-0	..	..	Dense jungle.
		9 4 0	1,757-0	599	..	Forest.
		0 2 200	..	..	..	Do.
		1 0 25	1,817-0	..	..	Do.
		1 2 180	1,847-0	..	..	Do.
		1 7 80	1,937-0	..	..	Forest.
		2 0 200	2,047-0	..	..	Forest.
		2 5 40	1,667-0	..	..	Forest.
		3 2 115	1,277-0	..	..	Forest.
		4 1 5	1,177-0	..	..	Forest.
		4 7 15	1,067-0	..	..	Forest.
		5 2 5	1,017-0	..	..	Forest.
		6 1 40	1,010-0	..	..	Forest.
	6 6 100	6 6 100	915-0	..	842	Camp at Majigaon in the jungle near a small clearing in the forest. Forest.
		0 6 50	..	..	..	Side lying ground rocky.
		0 7 120	895-0	..	..	Forest.
		2 0 190	815-0	..	..	Cleared to some extent.
		2 7 170	775-0	..	..	Black cotton soil, small area of wet cultivation.
		3 3 180	720-0	..	..	Jungle, forest sál and matti.
		4 0 70	..	..	..	Patna river 40' X 8'; bed stony, banks not well defined.
		4 7 80	745-0	..	..	Soil light and sandy.
		5 2 100	725-0	..	..	Forest. Chiefly matti and sál trees.
		5 7 55	715-0	..	..	Stream 20' X 6'. Stony bed.
		6 7 80	785-0	..	..	Forest.
		7 4 12	715-0	..	..	Forest.
		8 1 0	..	..	..	Stream 40' X 8'. Bed sandy, banks well defined.
		9 1 130	695-0	..	..	Village of Beheragata.
		9 2 64	..	..	..	Stream 18' X 5'.
		9 5 210	695-0	..	..	Low jungle.
		10 0 132	..	..	..	Town of Bondesor, called Bhavanipatnam, the capital of Kalahundy.
		10 4 0	695-0	..	186	Emerging from the town of Bondesor.
		11 1 0	705-0	..	..	Wet cultivation.
	11 3 140	11 3 140	729-0	..	..	Do.
		0 6 80	739-0	..	..	Stream 12' X 6'. Sandy bed, banks not well defined.
		1 1 60	..	..	..	Stream 9' X 6'.
		2 2 0	729-0	..	..	Do. 18' X 6'. Stony bed.
		2 5 20	..	..	..	Open country, well cultivated.
		2 6 0	..	..	..	
		3 2 50	727-0	..	..	

Statement of particulars describing Mr. Cormac's route, &c.—cont.

Distance from Village-palam.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.	FEET.	FEET.	FEET.	
		3 4 20	727-0	..	..	A large area under sugar-cane.
		4 7 119	687-0	..	..	Well-cultivated ground.
		5 6 178	687-0	..	..	Village of Bijapur.
		6 4 09	687-0	..	..	Abandoned fields and deserted village.
		7 4 6	597-0	..	..	Stream 20' X 6'. Sandy bed, banks not well defined.
		7 4 45	597-0	..	..	Town of Dadpur.
		8 4 0	597-0	..	..	Stream 12' X 8'. Wet cultivation to east.
		1 0 40	597-0	..	..	Cultivation in patches here and there.
		2 2 86	597-0	..	..	Village of Karriky, surrounding country all waste land.
		3 2 140	637-0	..	..	Side lying ground.
		3 5 70	590-0	..	..	Low saddle.
		4 5 10	648-0	..	..	Dry cultivation.
			..	..	..	River 80' X 15'. Sandy bed, banks well defined.
			..	..	..	Ground more or less rocky.
	13 4 315	6 0 170	558-0	..	171	Low lying ground; rice fields.
		1 1 194	556-0	..	..	Village of Komari.
			..	..	..	Patches of wet cultivation.
			..	..	..	Cultivated; surrounded by partially cleared jungle.
			..	..	..	Do. do.
		2 5 30	558-0	..	..	River 50' X 6'. Stony bed, banks not well defined.
		2 4 6	550-0	..	..	About 6 acres of wet cultivation near Jajrang; long grass.
		3 3 70	560-0	..	..	Small patches of cultivation in partially cleared jungle.
		4 1 20	660-0	..	..	Jungle partially cleared; konker trees in abundance.
		6 4 0	600-0	..	..	Village of Uthekela.
		6 1 100	600-0	..	..	High grass jungle.
		7 0 152	600-0	..	..	Village of Boris. Wet cultivation to east.
		8 4 70	608-0	..	..	River. Ret Noi (250 X 15).
		9 1 130	608-0	..	..	High ground, all cleared, patches of cultivation here and there.
		10 1 150	628-0	..	..	Village of Borimpodor, dry cultivation near.
		10 7 150	695-0	..	..	Village of San-kesinga, dry cultivation near.
		11 7 105	620-0	..	..	..
		12 0 0	608-0	..	..	..
	13 2 20	13 2 20	628-0	70	..	Camp at Bogor.

XXIX.

STATEMENT of Particulars describing Mr. Cormac's Route from Raipur (old Dhamtari) to Omorkot, distance 150½ miles.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. F. Y.	M. F. Y.	M. F. Y.	FEET.	FEET.	FEET.	
			963-0	..	..	Raipur; near the Deputy Commissioner's Office. Town of Raipur. Large tank.
		1 0 180	972-0	..	..	Just outside Raipur; near the cemetery. Tank. Road branches off east to Rajim. Native Infantry Rifle Range. Uncultivated land.
		2 5 166	952-0	..	..	Village of Boria Khoord. Large tank and fine tamarind trees; stream 12' X 8'; bridged.
		3 4 130	912-0	..	..	Wheat and linseed cultivation.
		5 3 200	892-0	..	..	Stream 24' X 8', bridged; sandy bed and well-defined clay banks. Avenues planted. Wheat and linseed cultivation.
		7 1 20	902-0	..	..	Stream bridged. Wheat and linseed cultivation.
		8 5 96	940-0	..	..	Stream 20' X 6'.
		9 3 40	930-0	..	..	Village of Amdul. All linseed cultivation.
		10 2 200	980-0	..	..	Stream 24' X 7'. Linseed cultivation.
		11 6 170	970-0	..	..	Tappal huts and well (stained) of water; fair camping ground; no shade.
11 7 71	11 7 71	11 7 71	970-0	7	..	Stream 50' X 9'.
		1 1 140	970-0	..	..	Village of Kolar. All cultivated ground.
		1 5 40	970-0	..	..	Stream 48' X 8'; sandy bed; good banks.
		2 3 200	980-0	..	..	Village of Khorpa. All ground under linseed cultivation.
		3 7 190	970-0	..	..	Village of Bhutgaon. All ground under cultivation. Stream 10' X 6'.
		4 7 68	950-0	..	..	Village of Rakhi. All land under linseed and wheat.
		6 2 170	930-0	..	..	Stream 60' X 9' clay; bed; well-defined banks; slightly undulating.
		7 4 50	910-0	..	..	Village of Kuchna. Stream 8' X 4'; good topes near villages.
		9 2 6	1020-0	50	..	Stream 80' X 14'; gravelly bed; good banks.
21 1 77	9 2 6	9 2 6	1020-0	50	..	Village of Kanamuka.
		1 3 80	1110-0	..	..	Village of Silturra. Camping ground not good.
		2 4 0	984-0	..	..	No good water. All open country, fully cultivated. Linseed cultivation.
		2 7 0	980-0	..	..	Village of Singdehi on East.
		4 0 50	990-0	..	..	Village of Supela on west.
		5 4 6	1000-0	..	..	Linseed cultivation. Country nearly flat.
		7 4 110	1000-0	..	..	Rice-fields.
		8 4 156	1040-0	20	..	Stream 23' X 7'; sandy bed; good banks. Castor-oil cultivation.
		1 0 0	1061-0	..	..	Village of Bhukara; 300 houses, Police station, school-house, tanks. Two acres laterite rock on surface; young mango topes; avenues all mangrove trees.
		1 5 130	1061-0	..	..	Open, flat country; rice-fields. Rice-fields.
		3 0 0	1026-0	..	..	Rice-fields. Village of Kusanmuka.
		4 2 70	1012-0	..	..	Village of Gujra; 80 huts. Residence of a Mahkdar. Four good tanks. Cultivated land.
		5 2 156	1019-0	..	..	Soil black clay.
		6 2 176	1005	..	..	Village of Doma. All cultivated land.
		7 0 53	995-0	..	..	Rice-fields. Soil black clay.
		7 5 173	1000-0	..	..	Village of Kurmataray. Small stream 6' X 3'.
			..	..	..	All cultivated lands. Soil black clay.
			..	..	..	Village of Denmar. Rice-fields, Soil black clay.
			..	..	..	Rice-fields. All cultivated land; some linseed and wheat crops.
			..	..	..	Rice-fields.
			..	..	..	Village of Arjuni.
			..	..	..	Village of Buthena. All land cultivated linseed and wheat; mango and tamarind topes; garden cultivation. Entering town of Dhamtari large tank and temple. Sandy soil.
			..	..	..	Town of Dhamtari; about 5,000 houses; 12,000 to 15,000 inhabitants. Tahsildar's Cutcherry, Police station, hospital and school.
39 5 138	9 7 125	9 7 125	1000-0	..	40	Good camping ground; good water; fine topes of mango and tamarind trees. Camp outside town of Dhamtari. Mango and tamarind topes. Sandy soil. Cultivated land; linseed, wheat, Bengal gram.
			..	..	..	Sandy soil.

Statement of Particulars describing Mr. Cormac's Route from Raipur, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		2 0 115	1060-0	..	..	Rice-fields.
		2 5 0	..	..	..	Village of Roodree. Large numbers of mango, matti, and ippa trees.
		2 6 160	..	..	..	Rice-fields.
		3 6 70	1030-0	..	..	Rocky ground.
		5 3 130	1030-0	..	..	Stream 24' X 6'; clay bed; banks not well defined; jungle. Patches of clearing and cultivation. Track parallel to the Mahanadi River.
		6 3 57	..	..	..	Village of Murradeo. Small village with a little cultivation near it. Scrub jungle with patches of cultivation. Soil stony. Jungle patches of wet and dry cultivation here and there.
		6 5 100	..	..	..	Soil stony. Village of Gangrel.
		7 2 6	1000-0	..	..	Mahanadi River; 1,449' X 17'; sandy bed; left bank well-defined clay.
		8 4 68	1000-0	..	..	Cleared; patches of cultivation.
		9 4 8	1030-0	..	..	Village of Kokri; small village; stratified gneiss rock on surface. Rice-fields. Jungle. Clearing along the track.
		11 1 55	1090-0	..	..	Ippe, matti, and some small teak trees.
52 2 98	12 4 180	12 4 180	1150-0	150	..	Villages of Batrel on west. Koralma on east. Stream 24' X 8'. Stream 620' X 8'.
		0 7 10	1169-0	..	..	Village of Lamkeni. Large area of cultivated land round village. Hill ridges on each side thickly wooded.
		1 4 58	1169-0	..	..	Village of Dargahan. Police Station. Large area of rice-fields. Swampy rice-fields.
		2 4 140	1169-0	..	..	Village of Sunghola on rising rocky ground. Small rocky hill in rear. Garden cultivation; rice-fields.
		3 3 106	1169-0	..	..	Village of Bhirawan. Small hills near village. Dry cultivation. Soil black clay.
		4 0 30	1225-0	..	..	Village of Mogragahan. Large area of rice-fields near village. Ippe trees abundant.
		6 3 80	1369-0	..	..	Stream 24' X 8'. Sugar-cane plantation. Stream 20' X 6'.
		7 5 80	1369-0	..	..	Swampy ground. Village of Alva, first in Kanker State. Dry cultivation near village.
62 4 182	10 2 84	10 2 84	1300-0	150	..	Waste land; high grass; ippe trees. Waste. Ippe trees abundant. Jungle.
		0 5 3	1250-0	..	..	Gravelly soil. All jungle, scrub, with ippe trees.
		0 7 186	1280-0	..	..	Stream 30' X 8'. Clay bed and banks. Stream 18' X 8'. Clay bed and banks.
		1 4 70	..	..	..	Village of Charima. Patches of cultivation here and there. Stream 18' X 6'. Sandy bed.
		2 0 150	..	..	..	Jungle clearing.
		2 3 125	1220-0	..	..	Village of Polawati. Uncultivated land. Swampy ground. Rice-fields.
		2 6 72	..	..	..	Trees of young mango trees.
		3 7 80	1250-0	..	..	Village of Sawada. One square mile rice-fields.
		4 6 180	1310-0	..	..	Stream 40' X 7'. Clay bed and banks. Rice-fields.
		5 7 0	1300-0	..	..	Village of Kurna.
		6 7 0	..	..	..	Mahanadi River. Open country. Some rice-fields.
		7 0 60	..	..	..	Half cultivated, half jungle.
		7 2 190	1270-0	..	..	Jungle. Sandy soil.
		8 6 0	1320-0	..	..	Jungle. Numerous ippe trees.
		9 7 58	1300-0	..	..	Jungle.
		10 1 99	1250-0	..	..	Makree River, 150' X 12'. Sandy bed; clay banks. Rice-fields.
73 4 12	10 7 50	10 7 50	1310-0	10	..	Village of Berawal. Jungle; numbers of ippe trees.
		1 5 0	1344-0	..	..	Jungle.
		2 3 0	1327-0	..	..	Town of Kanker.
		2 7 0	..	..	..	Dahd River, 115' X 8'. Sandy bed; clay banks.
		3 6 0	1310-0	..	..	Town of Kanker to west.
			..	..	..	Camp, beyond Kanker.
			..	..	..	Jungle.
			..	..	..	Some clearing and small area of rice-fields.
			..	..	..	Kanker limestone about.
			..	..	..	Jungle, very dense; no large trees. Matti trees.
			..	..	..	Hatkul River. Ground somewhat broken. Undulating ground.
			..	..	..	Stream 40' X 9'. Sandy bed; well-defined banks.

Statement of Particulars describing Mr. Cormac's Route from Raipur, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		4 0 210	1344-0	..	..	Village of Kongera; a few wretched huts. About 8 acres rice-fields. Jungle.
		5 2 33	1361-0	..	..	Stream 40' X 10'. Amordorgi. Sandy bed; clay banks; well defined.
		5 6 44	1327-0	..	..	Jungle.
		6 4 6	1378-0	..	..	Village of Aravali. Large clearing; extensive rice-fields.
		7 4 210	1429-0	..	..	Hatkul River (117' X 14').
		8 2 174	1412-0	..	..	In jungle sal, matti, ippe trees.
83 0 147	9 4 135	8 5 140	1497-0	..	..	Camp in jungle near Salabat.
		9 4 135	1520-0	210	..	Hatkul River bed.
		0 1 100	1470-0	..	..	Do. Sandy with cross ridges of rock at intervals. On river banks, through low scrub jungle.
		0 6 148	1480-0	..	..	Village of Chipraul. Forest good; large timber trees.
		2 0 83	1480-0	..	..	Forest.
		2 7 180	..	..	..	Do.
		3 3 0	..	..	..	..
		4 0 10	1510-0	..	..	Fine forest.
		4 6 90	1520-0	..	..	Cross section nearly level. Bamboo jungle.
		6 0 60	1550-0	..	..	Bamboo jungle.
		7 2 86	1610-0	..	..	Do.
		7 5 0	1710-0	..	..	Junction of two streams. Rocky bed. Much pink colored quartz.
		8 0 0	1800-0	..	..	Gneiss of various colors. Water-fall about 25 feet in height.
		9 0 0	1870-0	..	..	Rocky bed of river.
		9 6 443	2030-0	..	..	Junction with small stream from Siduwan. Sal jungle with undergrowth. Sal jungle.
94 3 37	11 2 110	11 2 110	2130-0	610	..	Sal jungle. Clearing.
		1 4 186	2122-0	..	..	Village of Siduwan. Large clearing. Rice-fields.
		2 4 92	2098-0	..	..	Swampy ground. Sal jungle. A few large trees, sal and matti.
		2 7 164	2122-0	..	..	Swampy ground. Rice-fields.
		4 3 116	2146-0	..	..	Stream 80' X 7'. Sandy bed; well-defined clay banks.
		5 0 130	2106	..	..	Soil sandy, brown clay. Village of Korgaon; a few miserable huts. Sal jungle.
		6 5 0	2122-0	..	..	Sal jungle. Soil sandy, brown clay; clearing.
		7 1 128	2092-0	..	..	Small stream dammed up for rice cultivation.
		8 6 12	2074-0	..	..	Village of Kalgan. Much gneiss rock cropping up. Sal jungle.
		9 4 200	2060-0	..	..	Sal jungle and date shrub; undergrowth. Stream 12' X 6'.
		10 0 210	2022-0	..	..	Village of Tumripura.
		10 5 90	2022-0	..	..	Jungle; small sal.
		11 3 16	2048-0	..	..	Village of Kajran. Garden cultivation; castor-oil trees, plantains and melons.
		12 5 26	2030-0	..	..	Rice-fields.
		14 3 10	2070-0	..	..	Stream 50' X 10'. Sandy bed; clay banks.
		1 2 96	2050-0	..	..	Bardhig River. Rice-fields.
		2 3 46	2040-0	..	..	Stream 15' X 6'. Rice-fields.
		2 4 136	2050-0	..	..	Village of Liagaon, a large village; extensive clearing. Garden cultivation. Rice-fields.
		4 2 110	2050-0	..	..	Stream 82' X 18'. Sandy bed; clay banks; well defined. Swampy land. Rice-fields.
108 6 47	14 3 10	5 1 20	2030-0	..	..	Village of Banskot; low jungle. Date shrubs.
		6 1 20	2030-0	..	..	Small sal. Jungle swamp. Rice-fields.
		7 1 79	2060-0	..	..	Soil black clay.
		9 2 43	2060-0	..	..	Village of Dodra. Jungle.
		11 0 160	2190-0	30	..	Jungle; small sal.
		1 1 180	2070-0	..	..	Village of Simora. Small area of rice-fields.
		3 0 0	2110-0	..	..	Stream 22' X 12'. Sandy bed; well-defined banks.
		3 3 170	2160-0	..	..	Village of Tumda. Sugar-cane and castor-oil tree cultivation. Two iron smelting furnaces at work.
			..	..	..	Village of Kudi in a small clearing.
			..	..	..	Sal forest; large trees.
			..	..	..	Village of Paorbel; not a good camping ground.
			..	..	..	Sal jungle; much undergrowth. Smaller village of Paorbel.
			..	..	..	Fine camping ground. Garden cultivation and rice-fields; sal jungle.
			..	..	..	Stream 20' X 7'. Sal jungle; open clearing.
			..	..	..	Sal jungle.

Statement of Particulars describing Mr. Cormac's Route from Raipur, &c.—cont.

Distance from Raipur.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		3 6 200	2170.0	..	..	Village of Odepur. Garden cultivation; rice-fields; sal jungle; swampy ground.
		6 0 20	2140.0	..	..	Sal jungle. Village of Mohundi.
		6 3 200	2090.0	..	..	Stream 24' X 6'. Rocky bed; clay banks. Smaller village of Mohundi. Sal jungle.
129 5 167	9 6 180	8 1 40	2100.0	..	..	Sal jungle.
		9 6 180	2120.0	30	..	Village of Gurjunga. Jungle; soil black clay.
		1 2 9	2090.0	..	..	Sal forest; large trees.
		1 5 100	2070.0	..	..	Stream 18' X 8'. Sandy bed; clay banks; scrub jungle.
		2 2 0	2055.0	..	..	Stream 58' X 9'. Rocky bed and banks; jungle.
		3 2 20	2060.0	..	..	Stream 40' X 8'. Rocky bed and banks; jungle.
		4 2 160	2050.0	..	..	Stream 20' X 8'. Rocky bed and banks.
		6 4 0	2120.0	..	..	Village of Kurulubahal; excellent camping ground and good shade. Extensive rice-fields and garden cultivation. Soil quartz gravel. Forest of sal.
		6 6 145	2135.0	..	..	Village of Serapur in a small clearing.
		8 1 75	2140.0	..	..	Jungle; sal with date shrub undergrowth. Jungle side lying ground.
		9 7 200	2120.0	..	..	Jungle; small sal trees.
141 4 147	11 6 200	10 4 25	2100.0	..	..	Clearing.
		11 6 200	2080.0	..	50	Village of Bakuda in a small clearing; jungle.
		0 6 100	2050.0	..	..	Stream 50' X 12'. Sandy bed; clay banks.
		1 5 165	2065.0	..	..	In jungle.
		2 1 20	2150.0	..	..	Stream 68' X 10'. Rocky bed and banks. Large area of rice-fields; swampy.
		3 6 110	2056.0	..	..	Village of Bandini; excellent camping ground.
		4 7 10	..	..	..	Tobacco, castor-oil trees, plantains; clearing.
		5 0 20	2080.0	..	..	Stream 18' X 9'.
		5 7 0	2065.0	..	..	Village of Barhona. Ippa, mango, and fig trees.
		6 2 130	2044.0	..	..	Stream 18' X 12'.
		7 4 100	2028.0	..	..	Village of Birendi; large area of rice-fields; good camping ground.
150 3 202	8 7 55	8 7 55	2021.0	..	59	Village of Kochlamo; tank and irrigation channel; area of rice-fields. Village of Omor-kot.
						Camp.

XXX.

STATEMENT of Particulars describing Mr. Cormac's Route from Papagaon (via Jeypur) to Kuraputi.

Distance from Papagaon.	Distance between Principal Stations.	Distance between Villages.	Height above M.S.L.	Rise.	Fall.	Remarks.
M. P. Y.	M. P. Y.	M. P. Y.	FEET.	FEET.	FEET.	
		0 3 160	1981.0	..	..	Camp near Papagaon. Stony soil.
		1 6 184	1963.0	..	..	Village of Papagaon. Topes of mango and tamarind trees. Swampy rice-fields. Stream 30' X 8'. Swampy rice-fields.
		3 1 4	1951.0	..	..	Village of Dangragoon; 10 houses, 50 people. Rice-fields; swampy ground; sal jungle; jack, ippa, and matti trees.
		4 2 200	1918.0	..	..	Village of Dondasanogoda on east; soil sandy. Rice-fields.
		4 7 94	1903.0	..	..	Stream 40' X 11'. Good banks; clay bed. Rice-fields.
		6 2 20	1933.0	..	..	Village of Randapali; 10 houses; mango and tamarind topes; good tank of water. Rice-fields.
		7 0 28	1891.0	..	..	Potra stream, 120' X 14'. Sandy bed; clay banks; mango tope. Rice-fields.
		7 6 56	1923.0	..	..	Village of Umerigaon; 60 houses; join road from Boriguma to Jeypur. Stream in swampy ground.
		8 7 110	1835.0	..	..	On high ground; jungle stream 12' X 8'. Wet cultivation to east, jungle to west.
		9 7 160	1929.0	..	..	Scrub jungle; large tank to the right.
		10 4 20	1937.0	..	..	Opposite travellers' bungalow; mango tope; tank.
	10 4 20	10 4 20	1955.0	..	26	Camp near Jeypur. Town of Jeypur; mango tope.
		0 5 0	1956.0	..	..	Join road from Jeypur to Kuraputi; ground rocky; side lying; jungle on both sides.
		1 1 80	2015.0	..	..	Jungle; hills on three sides. Stream 6' X 6'; stream 9' X 6'.
		1 5 160	2015.0	..	..	Jungle stream 12' X 6'.
		2 0 20	2015.0	..	..	Stream 63' X 14'. Rocky bed; clay bed.
		2 4 70	2003.0	..	..	Stream 6' X 4'. Ravine and stream on right.
		2 7 120	2207.0	..	..	Skirting hill side. Stream 6' X 4'.
		3 2 160	2351.0	..	..	Jungle; ravine on right.
		3 6 56	2267.0	..	..	Jungle.
		4 2 140	2589.0	..	..	Jungle; hill side cutting.
		4 5 170	2781.0	..	..	
		5 1 0	2889.0	..	..	Jungle.
		5 5 54	2805.0	..	..	Clearing.
		6 1 160	2867.0	..	..	Undulating ground.
		6 3 160	2915.0	..	..	Village of Bogepoder. Some cultivated ground along sides of streams. Stream 12' X 8'.
		7 3 0	2795.0	..	..	Village of Deeghati to the west; open cleared country.
		8 1 0	2843.0	..	..	Good trees about.
		8 5 70	2939.0	..	..	Open cleared country.
		9 3 100	2831.0	..	..	Cross road to Matsura.
		10 0 0	2891.0	..	..	Open country with sal jungle here and there.
		10 6 60	2903.0	..	..	Good shady trees at intervals.
		11 2 110	2915.0	..	..	Village of Damiguda.
		12 0 20	2999.0	1044	..	Saddle overlooking Kuraputi.
		12 2 110	2924.0	..	..	
		12 7 156	2864.0	..	..	Kuraputi.
13 3 14	13 3 14	13 3 14	2900.0	..	99	Agent's bungalow.

XXXI.

EXPLANATION OF VERNACULAR TERMS USED IN THESE PAPERS.

Vernacular Name.	English Name.	Botanical Name.	Remarks.
Alsi, sersá ...	Linseed ...	Linum usitatissimum	Alsi, Hind.; sersá, Tel.
Babool ...	A species of acacia ...	Acacia Arabica	Kuruveylam, Tam.; tummachettu, Tel.
Bandarachettu ...		Hymenodactylon ex- celsum.	
Bendakoi ...	Esculent okro ...	Hibiscus esculentus ...	Also called bhindi, ven- day.
Bhér, beri bair ...	Jujube tree ...	Zizyphus jujuba ...	Elendie, Tam.; reygoo. Tel.
Bora, bhora ...	Mangrove ...	Dolichos catjang ...	Bora, Beng.
Chenna ...	Bengal gram ...	Cicer arietinum ...	Chenna, Guz.
Cholum, Tam. ...	Great millet ...	Sorghum vulgare ...	Jonna, Tel.; jowari, Beng.
Cumboo ...	A small kind of millet	Momordica charantia.	Combu pagulkai, Tam.
Dhol ...	A kind of lentil ...	Cajanus indicus ...	Dhal, Hind.
Ganja, or janam nara.	Indian hemp ...	Cannabis sativa ...	Ganjar, Beng.; bhang, Hind.
Guntalu ...	A kind of grain ...	Pencillaria spicata ...	Gantelu, Tel.
Ippa, or ippie, or mbowa.	A fruit tree, with hard wood.	Bassia latifolia, Roxb.	The flowers yield toddy, and the seeds oil.
Ianam nara ...	Hemp ...	Cannabis sativa ...	Vide ganja.
Kenda, or kendoo, Hind.	Ebony ...	Diospyros melanoxylon.	Tumica, Tel.
Korra, or korra ...	A kind of grain ...	Panicum italicum ...	Korra is the plural of korra.
Matti, Can., or séja, Hind.	A good timber tree, wood dark brown.		Madhichettu, Tel.
Moorram ...	A kind of soil ...		
Myrabolams ...	Gallnuts ...		
Nara, or janam nara ...	Hemp ...	Cannabis sativa ...	Vide ganja.
Picota or pakota, Per- tuguese.	A machine used for raising water.		
Pipul, pipal ...	A species of ficus ...	Ficus religiosa	A sacred tree.
Ragi, or ragee ...	A small food grain ...	Eleusine striata, or coracana.	Nacheni, Hind.
Sál, sarái, salo ...	A good timber tree ...	Shorea robusta ...	Sál, Hind. and Beng.
Sámalu, Tel. ...	A small food grain ...	Panicum miliaceum ...	
Son, Hind. ...	Hemp ...		
Yerrakallu ...	Red garnets ...		

BELLARY,
28th August 1882.(Signed) K. F. NORDMANN,
Executive Engineer.

No. 89-A.

Note on proposed Railway to connect the Vizagapatam Sea-board with Raipur in the Central Provinces.

A preliminary reconnoissance of the country to be traversed was made during the cold season of 1881-82 by Mr. K. F. Nordmann, who examined several routes which had been suggested.

2. Mr. Nordmann concluded his examinations by stating that two routes distinctly commended themselves to him as being equally eligible—

(1) East of the Noagarh hills, passing near Párvatipur, Bissemkuttak, Ombadola, Assurgor, Karial, Nara, and Arang.

(2) West of the Noagarh hills, passing near Salur, Meriapad, Narangpur, Omorkot, Raigarh, Risgaon, Karti, and Rajim.

3. Mr. Nordmann started on his reconnoissance along the eastern route, and returned from Raipur to the coast along the western route. The following notes, extracted from his reports, are given in the direction in which each march was made.

EASTERN ROUTE.

Starting from Vizagapatam, the line proceeds *via* Bimlipatam, Vizianagrum, and Ramabhadrapuram to Párvatipur, 85 miles north of Vizagapatam and 395 feet above mean sea level. It then crosses the Narrainputnum river, where a waterway of 256 feet will be required, and enters the valley of the Nagavully (or Chicacole) river, in which it runs up to Ryaguddah, 687 feet, the distance being 116 miles. The line here keeps always within half-a-mile or so of the river bank.

From Ryaguddah the line passes through a fine upland country, crossing a river 363 feet wide at the 122nd mile. To the north of the river the upland valley continues as before to Gingerabadi, 736 feet, and proceeds to Ballingy 1,136 feet, and Satikona 1,346 feet, where the summit level of the line is reached. The ground then descends to Bissemkuttak, 1,154 feet (146 miles). From Bissemkuttak the line proceeds to Kordaband (158 miles) with a rise of 38 feet, attaining the height of 1,192 feet at this place.

After leaving Kordaband the line crosses several small streams, and passing through a gorge with dense jungle it then descends to flat ground, and following up the course of the Bongsdara river, crosses above the junction with the Ombadola river at a point requiring a waterway of 210 feet, rock being available for a foundation. Ombadola (170 miles) is then reached, the height being 1,196 feet.

The route from Ombadola northwards as far as Bogor (205 miles) is an easy one. The only approach to anything like a ghât is a decline which begins on the water-shed, 1,234 feet above mean sea level, $3\frac{1}{2}$ miles north of Ombadola. This ghât Mr. Nordmann states can easily be worked out at a gradient of 1 in 100.

At Bogor (205 miles, height 627 feet,) the Tel Nadi is crossed. The river is 1,560 feet wide between the banks; on one bank there is rock visible. The line then follows the course of the Sundur river, *via* Balipodor, Badbeng, Tukla, Karial, Kalniga, and Kumuna to Tobor (272 miles), which is 949 feet above mean sea level.

The line then passes a low water-shed, and proceeds through some dense jungle *via* Kandamuri, Siagori (290 miles), and Jalbal; whence proceeding *via* Nara, Surumal, Kopli, Patripali, Telebanda, and Mahasamund (339 miles) to Gorari 810 feet, where the Mahánadi is crossed. The width of the river here is 2,040 feet, and the bed sandy. On the eastern bank and in the bed is limestone rock; on the west bank none is visible. After crossing the Mahánadi the line continues to Arang (350 miles) and follows the Sumbalpur road to Raipur (372 miles). Height 962 feet.

The ground traversed all the way from Jalbal to Raipur is described as being practically almost level, the slopes easy, and the maximum gradient 1 in 100.

WESTERN ROUTE.

From Raipur, 963 feet, the line traverses a well-cultivated country to the south *via* Khandwa to Rajim (25 miles) where the Mahánadi is crossed, the river being 1,908 feet broad at this place. The line then follows the right bank of the Pairi river. The ground traversed is described as being on the whole very favorable, and the country fully cultivated as far as and beyond Kopra, 35 miles from Raipur. The gradients are generally light. Still keeping close to the Pairi river, the line proceeds to Bourka (47 miles, height 992 feet,) where some hillside cutting will be required for upwards of a mile along the steep and stony banks of the river. Some of the heaviest work along the line will be necessary here.

Proceeding to Karti (52 miles) the line here crosses to the left bank of the Pairi river at a place 1,530 feet wide, and continues along the right bank of the Sundur river *via* Baltema 1,295 feet, and Tumaribahal to Karku, where it crosses the Bog river, 50 feet wide, and proceeds due south to Risgaon (104 miles), Gourgaon, and Hathgaon (112 miles).

The ascent up to Hathgaon (1,870 feet above mean sea level) is a very gradual one. From this place the final ascent to the Jeypur plateau commences. A total height of 220 feet has to be overcome, which, distributed over five miles, gives a gradual rise of 44 feet per mile, or 1 in 120. The line passes through many miles of magnificent forest, and continues *via* Kolaipoder, Raigarh, and Bera to Omorkot, 137 miles from Raipur. From Omorkot the line, trending to the south-east, passes Bijapur (155 miles), Dobgaon, Paparhandi, and Narangpur (185 miles) to Ranigar (210 miles) at the foot of the Madeoputi Ghât, tapping a rich and beautiful upland country, with fertile soil, and fine forest and jungle, at an average elevation of 1,900 feet. The surface in most parts is level.

The line then continues *via* Madeoputi and Mastiput (220 miles, height 2,520 feet,) up to Dengagura, on the Kuraputi plateau (223 miles, height 2,900 feet), and proceeds thence *via* Chikapor to Doliamb, along a 3,000 feet plateau. The ground here undulates considerably, but an easy line can be obtained by keeping along the low ground, and following the course of the longitudinal valleys leading in the direction of the line. Some high embankments would be required, but not much cutting.

The line then continues to the Dokrigat Saddle (3,190 feet); after passing which, it turns due east over the Merialpad Saddle (3,250 feet), passes Dobata (2,600 feet) and the Rodavalsa Saddle (2,001 feet)—a viaduct and tunnel being here required—and proceeds thence to Salur, 570 feet. The descent from the Merialpad Saddle to the plains is somewhat abrupt, the heavy fall of 2,680 feet having to be encountered within some 20 or 30 miles, according to the line chosen.

The entire length of the western route from Raipur to Vizagapatam will vary from 356 to 343 miles.

4. When the proposal was first made by the Madras Government for the survey of a line of railway to connect the Vizagapatam sea-board with the Central Provinces, Raipur was named as the point to be made for, as it was understood that a railway was then being constructed between Nagpur and Raipur. The conditions affecting the proposal have however been greatly modified by the investigations which have been subsequently made with the object of connecting the East Indian Railway at Sitarampur with the Nagpur-Chattisgarh Railway at Belaspur; and it will probably be now considered open to question whether Raipur is the most suitable point of junction for the two lines.

5. For purposes of comparison between the two lines reconnoitred by Mr. Nordmann, Raipur may however be conveniently accepted for the present as the terminus of the proposed Vizagapatam line, and the leading features of the two routes may be briefly stated as follows:—

The eastern route crosses a summit level of 1,346 feet; it is 372 miles in length, with a ruling gradient of 1 in 100, or less.

The western route crosses a summit level of 3,250 feet; it is either 356 miles in length with ruling gradient of 1 in 50; or 343 miles in length, with ruling gradient of 1 in 35.

6. The comparative cost of constructing a metre gauge railway along the two routes has been roughly estimated by Mr. Nordmann as follows:—

Eastern Route.		£
372 miles at £5,000 ...	...	1,860,000
Add for some heavy work near Ombadola, 5 miles, at £2,000 ...	...	10,000
Add for bridges ...	...	30,000
Total ...		1,900,000

The item of bridging is heavier on this line than on the other.

Western Route.

Raipur to foot of upper plateau at Ranigar, 204 miles, at £5,000 ...	1,020,000
Ghât from Ranigar to Limka Saddle, 14 miles, at £8,000 ...	112,000
Limka Saddle to Merialpad Saddle along the upper plateau, 33 miles, at £6,000 ...	198,000
Ghât from Merialpad Saddle to foot in the plain (4 miles north-west of Salur) by the longest route (b), 32 miles, at £10,000 ...	320,000
Foot to Salur and Vizagapatam, 73 miles, at £5,000 ...	365,000
Total ...	2,015,000

Or,

Raipur to foot of upper plateau at Ranigar, 204 miles, at £5,000 ...	1,020,000
Ghât from Ranigar to Limka Saddle, 14 miles, at £8,000 ...	112,000
Limka Saddle to Merialpad Saddle along the upper plateau, 33 miles, at £6,000 ...	198,000
Ghât from Merialpad Saddle to foot by shortest route (c), 19 miles, at £10,000 ...	190,000
Add for tunnel and viaduct ...	50,000
Foot of hills to Vizagapatam as before, 73 miles, at £5,000 ...	365,000
Total ...	1,935,000

These figures show a slight difference in favor of the eastern route; but, looking to the uncertainty which must attend the execution of the heavy ghât and tunnel works on the western line, in a locality which has acquired an unenviable reputation for malaria, it is not improbable that the difference in cost between the two routes will be considerably more.

7. With respect to the nature of the country traversed by the two routes there does not seem to be much difference. The construction of a railway along either route will serve to open out a vast tract of new and undeveloped country, apparently abounding in natural resources of all kinds.

8. From an engineering point of view, there can be no room for doubt in giving an opinion between the alternative routes; and the same may be as decidedly asserted from the point of view of railway traffic. This is conclusively shown by the figures in Mr. Nordmann's map, giving the heights above sea level of the various points reached, as fixed by aneroidal observations.

The western route encounters the line of ghâts at a part where the lowest practicable saddle is 3,250 feet above sea level. In order to reach that saddle, it makes an abrupt rise of 2,680 feet within 23 or 35 miles, according to the line selected; while within the next 30 miles it falls 1,250 feet. If a railway were taken over the hills by the western route, every ton of goods carried between the Central Provinces and the coast would have to be carried, up and down, some 2,500 feet unnecessarily, besides being debited with the haulage charges on the steep gradients of the ghât. It must also be borne in view that the heavy ghât work lies within a tract which is notoriously unhealthy; and that the unhealthiness will affect not only the construction of a railway, but also its subsequent working.

The eastern route passes through the line of ghâts at a singularly favorable saddle near Ombadola, and the highest point which it touches is 1,346 feet above sea level. The only part which approaches the nature of a ghât lies to the north of the Ombadola watershed, where Mr. Nordmann states that a gradient of 1 in 100 may be necessary for about 4 or 5 miles.

9. The facts and figures collected by Mr. Nordmann during his reconnoissance seem to prove that the main line of the proposed railway should be carried from the sea-board northward, through the Ombadola gap, as far at least as Assurgor. Whether from Assurgor the line should follow the route reconnoitred by Mr. Nordmann, in a north-westerly direction, to Raipur, or should trend to the north-east, passing near Sonapur and Sambalpur, to join the proposed line between Sitarampur and Belaspur, will probably depend upon the decision arrived at by the Government of India respect-

ing the route to be followed by that line. It appears far from improbable that there is room for both lines in the vast tract of country to be served. If it be considered essential that the Jeypūr plateau be tapped, a branch could without difficulty be led off from Ryaguddah towards Narangpūr, which would avoid the chief difficulties of the western route over the hills. From Narangpūr the branch could be extended in any direction that may seem desirable. Other branches from the eastern main line could also be made without difficulty.

11th September 1882.

(Signed) J. SHAW-STEWART, Col., R.E.,
Consulting Engineer for Railways.

No. 89-B.

Letter from the Government of India, dated 12th August 1882, No. 692 R.C.

No. 90.

ORDER—dated 13th September 1882, No. 2366 W., Public Works.

Ordered that the following letter be addressed to the Government of India.

(Here enter No. 2367 W., dated 13th September 1882.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Consulting Engineer for Railways, with copy of letter.
" Financial Department.

Exd. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Gobt. of 1882 Madras.
PUBLIC WORKS.

Dated September, 13th.

Recd.

Encl.

G.O., 13th Sept. 1882, No. 2366 W.

SEPTEMBER.
Nos. 89-90.

Vizagapatam-Raipur Railway.
Reports on the reconnoissance for the —,
ordered to be forwarded to the Government
of India.

13TH SEPTEMBER 1882, No. 2367 W., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 91.

LETTER—FROM

COLONEL R. H. SANKEY, C.B., R.E.,

Secretary to Government, Public Works Department,
Madras,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT.

SIR,

With reference to your letter, No. 692 R.C., dated 12th August 1882, on the subject of the report of the results of the reconnoissance undertaken with a view to decide the best line for a railway between the littoral of Vizagapatam and Raipur in the Central Provinces, I am desired by the Right Honorable the Governor in Council to express regret at the delay which has occurred in laying the results before the Government of India. The following explanation will show that this has been unavoidable. Owing to the numerical weakness of the establishment, the officer who conducted the investigations had, immediately on his return from Vizagapatam, to be placed in executive charge of a division, and in addition he had temporarily to carry on the current duties of the Superintending Engineer; so that he had no time to elaborate his original reports which were, necessarily, submitted in the first instance in a somewhat crude form. In consequence, the task of passing the reports through the press, correcting the proofs and calculations of altitudes, marking the routes, and preparing detailed statements in a tabular form of the particulars given on the various sections, devolved on the Chief Engineer's Office, already overburdened with the current work of the department. The papers had afterwards to be sent to Bellary, in view to their final revision by Mr. Nordmann, from whom they have just been received.

Introduction to the Reports.

Letter from Mr. Nordmann, No. 14 R., dated 16th November 1881.

Letter from Chief Commissioner, Public Works Department, Central Provinces, No. 9059, dated 16th November 1881.

Letter from Mr. Nordmann, No. 19 O, dated 26th November 1881.

Do. do., No. 20 B, dated 4th Dec. 1881.

Do. do., " 24 R, " 6th Jan. 1882.

Do. do., " 27 R, " 14th " "

Do. do., " 38 K, " 25th Feb. "

Do. do., " 60 W, " 30th Mar. "

Do. do., " 72 W, " 14th April "

Do. do., " 74 W, " 18th " "

Statement of particulars and sections, &c.
Brief Note by Consulting Engineer.
Route Map.

2. In order to avoid further delay, I am directed to forward herewith copies of the printed reports, &c., together with a brief note thereon by the Consulting Engineer to this Government. In doing so, I am to explain that the papers in question are now under the consideration of this Government, and that their views thereon shall be forwarded at the earliest possible date.

I have the honor to be,
Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

OOTACAMUND,
13th September 1882.

Exd. S. T. Austin.

Spare Copies

BUILDINGS AND ROADS,
CIVIL WORKS.

Govt. of (1882) Madras
PUBLIC WORKS.

Dated September, 13th.

Recd.

Encl.

13th Sept. 1882, No. 2367 W.

SEPTEMBER
No. 91.

Vizagapatam-Raipur Railway.

FORWARDING with remarks the reports of
the reconnoissance for the —

All communications
should be addressed to
the Secretary.

No. 692: R.C.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

Railway Construction.

ny
Co

The Secretary to the Government of Madras
Public Works Department.

Simla, 12th August 1882.

Sir,

Adverting to Public Works Department
telegram of 9th instant asking how soon the
report of the railway reconnoissance between
Vizagapatam and Raipur may be ex-
pected I am directed to state that the
Government of India desires to consider
the case as soon as possible in order
that advantage may be taken of the
coming cold season to prosecute the
work or such portions of it as may
be thought desirable.

2. His Excellency the Governor
General

General in Council is well aware of the wild and inhospitable nature of the country through parts of which the surveys have had to be taken, and doubtless the survey party has had much to contend against but His Excellency considers that some record of the results might have reached the Government of India before this. The surveys between Bilaspur in the Central Provinces and Calcutta were ordered to be undertaken at the same time, and the preliminary report by the Engineer-in-Chief of the surveys was in the hands of the Government of India in May last.

Ch. 2. 564 C. 9-3-92.
 " 569 C. 8-4-92.
 " 640 C. 11-3-92.
 " 1023 R. 26-4-92.
 " 2754 " 14-11-91
 " 2904 R. 17-11-91
 " 2977 R. 1-12-91
 " 430 R. 17-2-92.
 " 1341 C. 5-7-92.

I have the honor to be,
 Sir,
 your most obedt. servant,

M. D. B. Esq. Secy. to Govt. of India

12/4/92 Recd. 6/9 R. 7/9
 12/12/87
 Documents accompanying Secretary
 C. 11

Note on proposed railway to connect the Vizagapatam sea-board with Raipur, in the Central Provinces.

A preliminary reconnaissance of the country to be traversed was made during the cold season of 1881-82, by Mr. H. J. Nordmann, who examined several routes which had been suggested.

Mr. Nordmann concluded his examinations by stating that two routes distinctly commended themselves to him as being equally eligible:—

- (1) East of the Nagarkh hills, passing near Parvatipuram, Bissenhatta, Ombadola, Asurgor, Kariak, Nara, and Mang.
- (2) West of the Nagarkh

hills, passing near Salur,
Merialpad, Narangpur,
Omorkote, Raigurh, Shigga,
Kartu, and Rajim.

3-
Mr. Nordmann started
on his reconnaissance
along the eastern route,
and returned from Raipur
to the Coast along the
western route. The following
notes, extracted from his
reports, are given in the
direction in which each
march was made.

Eastern Route.

Starting from Vizagapatam,
the line proceeds via Spin-
lapatam, Vizianagram,
and Ramabhadrapuram,
to Parvatipuram, 85 miles
north of Vizagapatam and
395 feet above mean-sea-
level. It then crosses the
Narainputnam river, where

11348
a waterway of 250 feet will
be required, and enters the
valley of the Nagavully,
(or Chicacole) river, in which
it runs up to Ryaguddah,
687 feet, - the distance being
116 miles. The line here keeps
always within half-a-mile
or so of the river bank.

From Ryaguddah, the
line passes through a fine
upland country, crossing a
river 363 feet wide at the
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of the river, the upland
valley continues as before
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and proceeds to Ballingy,
1136⁶ feet, and Satekora
1346 feet, where the summit
level of the line is reached.
The ground then descends
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Kordaband (158 miles)
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attaining the height of
1192 feet at this place.

After leaving Kordaband,
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small streams, and passing
through a gorge with
dense jungle, it then
descends to flat ground,
and following up the
course of the Bongodara
river, crosses above the
junction with the Ombadola
river at a point re-
quiring a waterway of
210 feet, - rock being avail-
able for a foundation.

Ombadola (170 miles) is
then reached, - the height
being 1196 feet.

The route from Omba-
dola northwards as far
as Bogor (205 miles) is an
easy one. The only

174 S.
approach to anything
like a ghat is a decline
which begins on the water-
shed, 1233¹/₂ feet above mean
sea level, - 3 1/2 miles north
of Ombadola. This ghat
Mr. Nordmann states can
easily be worked out at
a gradient of 1 in 100.

At Bogor (205 miles,
height 627 feet,) the Tel-
Nadi is crossed. The
river is 1500 feet wide
between the banks. on
one bank there is rock
visible. The line then
follows the course of the
Sundur river, via Bali-
podor, Badheng, Tukla,
Kariak, Kaluiga, and
Kumana, to Tobor, (272
miles) which is 949 feet
above mean sea level.

The line then passes
a low watershed, and

proceeds through some
dense jungle via Kanda-
mpuri, Seilguri, (290 miles)
and Jalbal, whence pro-
ceeding via Nara, Surmal,
Kopli, Patupali, Telebada,
and Mahasamund, (339
miles) to Gorari 810 feet,
where the Mahanadi is
crossed. The width of the
river here is 2,040 feet,
and the bed sandy.
On the eastern bank and
in the bed is limestone
rock; on the west bank
none is visible. After
crossing the Mahanadi,
the line continues to Braug
(350 miles) and follows
the Sambalpur road to
Raipur (372 miles). Height
962 feet.

The ground traversed
all the way from Jalbal
to Raipur is described

PS-80
as being practically almost
level, the slopes easy, ^{or}
and the maximum ^{or}
gradient 1 in 100.

Western Route.

From Raipur, 963 feet,
the line traverses a well
cultivated country to the
south, via Khairawa, to
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The river being 1908 feet
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and beyond Kopra, 35
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Still keeping close to the Pauri river, the line proceeds to Bourka, (47 miles, height 992 feet,) where some hill-side cutting will be required for upwards of a mile, along the steep and stony banks of the river. Some of the heaviest work along the line ~~there is easy though~~ will be necessary here.

Proceeding to Kanti, (52 miles,) the line here crosses to the left bank of the Pauri river at a place 1530 feet wide, and continues along the right bank of the Sunder river, via Baltema 1295 feet, and Tumaribahal, to Harker, (where it crosses the Bag river, 50 feet wide, and proceeds due south to Rogaon (104 miles), Gurgaon, and Hathgaon (112 miles).

The ascent up to Hathgaon (1870 ft above mean sea level) is a very gradual one. From

186
this place the final ascent to the Jeypur plateau commences. A total height of 220 feet has to be overcome, which, distributed over five miles, gives a gradual rise of 44 feet per mile, or 1 in 120. The line passes through many miles of magnificent forest, and continues via Kolai-podar, Raigarh, and Bera, to Omor Kote, 137 miles from Raipur.

From Omor Kote, the line, trending to the South-east, passes Bijapur (155 miles), Dobgaon, Sapanhandi, and Narainpur, (185 miles) to Ranigar (210 miles) at the foot of the Madhopur ghat, tapping a rich and beautiful upland country, with fertile soil, and fine forest and jungle, at an average elevation of 1900 feet. The surface in most parts is level. #

The line then continues via

Madhapur, and Mastipur,
(220 miles, height 2520 feet),
up to Dengagura, on the
Kuraput plateau (223 miles,
height 2900 feet)

From Dengagura, the line
gradually ascends to Dura-
put (2799 ft.), and proceeds thence
via Chikapor to Doliamb,
along a 3000 feet plateau.
The ground here undulates
considerably, but an easy line
can be obtained by keeping
along the low ground, and follow-
ing the course of the longitudinal
valleys leading in the direction
of the line. Some high embankments
would be required, but not much
cutting. The line then continues to the
Dokrigat saddle (3190 feet), after
passing which, it turns due east over
the Meriapad saddle (3250 feet), passes
Dobata (2600 feet) and the Rodavala
saddle (2001 feet) - a viaduct and
tunnel being here required, - and ^{proceeds} thence
to Salur 570 feet. The descent from the
Meriapad saddle to the plains is
somewhat abrupt; the heavy fall of
2680 feet having to be encountered
within some 20 or 30 miles, according
to the line chosen.

The entire length of the
western route from Raipur to
Vizagapatam will vary from
356 to 343 miles.

89
When the proposal was
first made by the Madras
Government for the survey
of a line of railway to
connect the Vizagapatam
sea-board with the
Central Provinces, Raipur
was named as the point
to be made for, as it
was understood that a
railway was then being
constructed between Nagpur
and Raipur. The conditions
affecting the proposal have
however been greatly modified
by the investigations which
have been subsequently made
with the object of connecting
the East Indian Railway
at Titarampur with the
Nagpur-Chattisgarh
Railway at Belaspur;
and it will probably
be now considered open

to question whether Raipur is the most suitable point of junction for the two lines.

For purposes of comparison between the two lines reconnoitred by Mr. Nordmann, Raipur may however be conveniently accepted for the present as the terminus of the proposed Vizagapatam line; and the leading features of the two routes may be briefly stated as follows:-

The eastern route crosses a summit level of ¹³⁴⁶ ~~1245~~ feet; it is 372 miles in length; with a ruling gradient of 1 in 100, or less.

The western route crosses a summit level of 3250 feet; it is either 356 miles in length, with

8 13
ruling gradient of 1 in 50, or 343 miles in length, with ruling gradient of 1 in 35.

b. The comparative cost of constructing a metre gauge railway along the two routes has been roughly estimated by Mr. Nordmann as follows:-

<u>Eastern Route</u>		£
372 miles at £ 5000		1,860,000
Add for some heavy work near Ambadola 5 miles at £ 2000		10,000
Add for bridges		30,000
Total		£ 1,900,000

The item of bridging is heavier on this line than on the other.

<u>Western Route.</u>		
Raipur to foot of upper plateau at Ranigar, 204 miles at £ 5000		1,020,000
Ghat from Ranigar to Simika Saddle, 14 miles at £ 8000		112,000
Simika Saddle to Merialpad Saddle along the upper plateau 33 miles at £ 6000		198,000
Ghat from Merialpad Saddle to foot in the plain (4 miles north-west of Salur), by the longest route (b) 32 miles at £ 10000		320,000
Foot to Salur and Vizagapatam 73 miles at £ 5000		365,000
Total		£ 2,015,000

<u>or,</u>		
Raipur to foot of upper plateau at Ranigar, 204 miles at £ 5000		1,020,000
Ghat from Ranigar to Simika Saddle, 14 miles at £ 8000		112,000
Simika Saddle to Merialpad Saddle along the upper plateau, 33 miles at £ 6000		198,000
Ghat from Merialpad Saddle to foot by shortest route (c) 19 miles at £ 10000		190,000
Add for tunnel and viaduct		50,000
Foot of hills to Vizagapatam as before, 73 miles at £ 5000		365,000
Total		£ 1,935,000

These figures show a slight difference in favour of the eastern route, but, looking to the uncertainty which must attend the execution of the heavy ghat and tunnel works on the western line, in a locality which has acquired an unenviable reputation for malaria, it is not improbable that the difference in cost between the two routes will be considerably more.

7. With respect to the nature of the country traversed by the two routes, there does not seem to be much difference. The construction of a railway along either route will serve to open out a vast tract of new and undeveloped country, apparently abounding in natural resources of all kinds.

8.

129
From an engineering point of view, there can be no room for doubt in giving an opinion between the alternative routes, and the same may be as decidedly asserted from the point of view of Railway traffic. This is conclusively shown by the figures in Mr. Nordmann's map, giving the heights above sea level of the various points reached, as fixed by aneroidal observations.

The western route encounters the line of ghats at a point where the lowest practicable saddle is 3250 feet above sea level. In order to reach that saddle, it makes an abrupt rise of 2680 feet within 23 or 25 miles,

according to the line selected,
while within the next 30 miles,
it falls 1250 feet. If a
railway were taken over
the hills by the western
route, every ton of goods
carried between the Central
Provinces and the Coast
would have to be carried
up and down, some 1500 feet
unnecessarily, besides being
debited with the haulage charges
on the steep gradients of
the ghat. It must also be
borne in view that the
heavy ghat work lies within
a tract which is notoriously
unhealthy, and that the
unhealthiness will affect
not only the construction of
a railway, but also its
subsequent working.

P 10 5
The eastern route passes
through the line of ghats
at a singularly favorable
saddle near Omhadola;
and the highest point which
it touches is ¹³⁴⁶ ~~1345~~ feet
above sea level.

The only part which
approaches the nature of a
ghat lies to the north of
the Omhadola watershed,
where Mr. Nordmann states
that a gradient of 1 in 100
may be necessary for about
4 or 5 miles.

9- The facts and figures
collected by Mr. Nordmann
during his reconnaissance
seem to prove that the
main line of the proposed
railway should be carried
from the sea-board northwest

through the Omhadola
gap, as far at least as
Ahpungor. Whether, from
Ahpungor, the line should
follow the route recom-
mended by Mr. Nordmann,
in a northwesterly direction,
to Raipur; or should trend
to the north-east, passing
near Sonepur and Sambhal-
pur, to join the proposed
line between Sitarampur
and Belaspur, - will
probably depend upon the
decision arrived at by the
Govt of India respecting
the route to be followed
by that line. It appears
far from improbable that
there is room for both lines
in the vast tract of
country to be served

11 66
If it be considered essen-
-tial that the Jaspur
plateau be tapped, a
branch could, without diffi-
-culty be led off from
Ryaguddat towards Narang-
pur, which would avoid
the chief difficulties of the
western route over the hills.
From Narangpur, the branch
could be extended in any
direction that may seem
desirable. Other branches
from the eastern main line
could also be made without
difficulty.

6-9-82

11
Signed J. Shaw Stewart
Genl Secy
Comm. Engrs & Archts

Consulting Engineer
Note to be printed
with the Lm.

R.S. 11-9

XXXI

Explanation of Vernacular terms used in these papers

Vernacular name	English name	Botanical name	Remarks
Alsi, sersá	linseed	linum usita- tissimum	alsi, hind. sersá, tel.
Babool	a species of acacia	acacia arabica	kurnwaylam, tam. tumonachettu, tel.
Baudára chettu	—————	pyramodictyon excelsum	—————
Beu da kai	esculent okro	hibiscus esculentus	also called bhindi, Vunday
Bhér, beri bair	jigube tree	Zizyphus jujuba	elendie, tam. reygos, tel.
Bora, bhora	mangrove	dolichos Catjang	bora, beng.
Chenna	Bengal gram	cicer arietinum	Chena, guj.
Cholum, tam.	great millet	sorghum vulgare	jonna, tel. jowari, beng.
Cumboo	a small kind of millet	momordica charantia	combu pagul- -kai, tam.
Dhol	a kind of lentil	cajanus indicus	dhal, hind.
Ganja, or janam nara	Indian hemp	cannabis sativa	ganjar, beng. bhang, hind.

Explanation of Vernacular terms, continued.

Vernacular name	English name	Botanical name	Remarks
Guntalu	a kind of grain	<i>penicillaria spicata</i>	gantelu, tel.
Ippa, or ippie, or mpowa	a fruit tree, with hard wood	<i>Bassia latifolia</i> , Roxb.	
Janam nara	hemp	<i>cannabis sativa</i>	The flowers yield toddy, and the seeds oil vide Gauja
Keuda, or Keudoo, hind.	ebony	<i>diospyros melanoxylon</i>	tumica, tel.
Korrahu, or Korra	a kind of grain	<i>panicum italicum</i>	Korrahu is the plural of korra
Matti, Can., or saja, hind.	a good timber tree, wood dark brown	_____	madhi chettu, tel.
Moorrum	a kind of soil	_____	_____
Myrabolams	gall nuts	_____	_____
Nara, or Janam nara	hemp	<i>cannabis sativa</i>	vide Gauja
Picota or pakota, Portuguese	a machine used for raising water	_____	_____
Pipul, pipal	a species of figs	<i>figus religiosa</i>	a sacred tree

Explanation of Vernacular terms, continued.

Vernacular name	English name	Botanical name	Remarks
Ragi, or ragee	a small food grain	<i>eleusine stricta</i> , or <i>coracana</i>	Nacheni, hind.
Sál, sarái, salo	a good timber tree	<i>Shorea robusta</i>	Sál, hind. & beng.
Sámalu, tel.	a small food grain	<i>panicum mili-aceum</i>	_____
Son, hind.	hemp	_____	_____
yerra Kallu	red garnets	_____	_____

Bellary
28th August 1882

K. F. Nordmann
Executive Engineer

XXXI.

Explanation of
Vernacular Terms
used in the
foregoing papers

Current Month No. & Date	Subject	Date of Receipt from Mr. Nordmann	When original sent to the Press	When 1 st Proof recd from the Press	When 1 st Proof recd from the Press	When 2 nd Proof recd from the Press	When 2 nd Proof recd from the Press	When 3 rd Proof recd from the Press	When 3 rd Proof recd from the Press	When 4 th Proof recd from the Press	When sent to Mr. Nordmann	Remarks
7221 26 th Nov/81	Reconnaissance from Parvatiपुरam to Rya gudolah	8 th Decem/81	31 st Janu/82	18 th Feb/82	9 th March/82	"	"	"	2 nd June/82	12 th June/82	4 th Proof sent to Mr. Nordmann	
7509 4 th Decem/81	Report on the reconnai- sance from Ombadola to Bogor	20 th Decem/81	do	do	do	3 rd June/82	"	"	do	do	4 th Proof sent to Mr. Nordmann	
205 6 th Janu/82	do - do - from Bogor to Raipur	12 th Janu/82	31 st Janu/82	do	do	"	"	"	do	do	4 th Proof sent to Mr. Nordmann	
390 30 th Decem/81	Extracts from notes of reconnaissance from Bogor to Raipur	21 st Janu/82	31 st Janu/82	do	do	"	"	"	do	do	4 th Proof sent to Mr. Nordmann	
1478 25 th Feb/82	Reconnaissance of the country between Raipur & Kurapatti via Rajim Kopra & do	8 th March/82	13 th March/82	25 th March/82	"	5 th May/82	27 th May/82	"	"	"	3 rd Proof sent to Mr. Nordmann	
2269 30 th March/82	Submits sections of reconnaissance from Raipur to Kurapatti	12 th April/82	5 th May/82	27 th May/82	2 nd June/82	"	"	"	"	"	2 nd Proof sent to Mr. Nordmann	
2551 14 th April/82	Submits 11 revised sections of country reconnoitered between Ryagudolah the Mussa ghaut, Bondesor.	24 th April/82	31 st May/82	20 th June/82	"	"	"	"	"	"	1 st Proof sent to Mr. Nordmann	
2783 18 th April/82	Final reports on the reconnaissance	3 rd May/82	31 st May/82	do	"	"	"	"	"	"	1 st Proof sent to Mr. Nordmann	
6849 16 th Novem/81 & 6920	Letters from Mr. Nord- mann & from the Secre- tary to the Chief Com- missioner Central Provinces on the subject of the reconnaissance for the Vizagapatam & Raipur	22 nd Novem/81 & 25 th Novem/81	5 th Decem/81	"	2 nd June/82	6 th June/82	"	"	"	"	1 st Proof sent to Mr. Nordmann	

Chief Eng's Office
Chepauk 31st August/82

[Signature]

* N.B. This represents the date on which the paper was first
sent to press. Table printed in Press form. It was only
recently taken up by Mrs. Pope to be prepared for the collection
& it was then sent to press towards the end of Aug.

With reference to
C. A. W.'s note asking for
details as to the work done
in connection with Mr. Nord-
mann's report I beg to
explain as follows.

1. I had to mark the routes
followed on Mr. Nordmann's
map as also on the one for
the Secretary.
2. Prepare statements from
the sections showing the
distances, the names of
places, nature of the
soil, levels &c along the
route.
3. Enter the correct names
of all the places along
the routes in the Reports.
4. Compare & correct the
proof sheets of the Reve-
rable reports.
5. The statement accom-
panying shows the date
of passing of the several
proof sheets to and
from the Press & I beg
to submit that there
was no delay on my
part at all as the
work

Routes were also shown in
Tabular form.

This was really a revision of
the Reports. The spelling of
all names having to be
taken from the maps.

The altitudes had
all to be revised by Mr.
Nordmann's later obser-
vations.

work to be turned out
by me was very tedious
& laborious, especially
following the route &
correcting the names
on the several proofs
owing to the difference
of names as given in
the reports & those shown
on the maps.

Chapman
2nd paper
1882

Ind. C. C. C.

Mr. K. K. K. had to
use the "proofs" finally
and give the final list to
Botanical Equivalents
for all native names of
products - Botanical
lists had to be consulted
to make them to be
done -

C. No. 5565

to W

I have written to
Madras for a complete
Diary of work done
in connection with
these Reports with full
explanations of delays
which have occurred
in getting the papers
ready. The papers were
a long time in the
Press, but a great
deal of work was left
to be done by the
office in verifying
localities, tracing
routes, and revising
altitudes.

On receipt of the
information called
for, the draft letter
required by St. C. the
Governor can be
prepared.

R. S.

which he still continues

C. A. W.

any word - so
soon as we can
leave details re-
solving the delays
the letter in P.R.
wishes it can be
drafted

23.8.82
To R
Please see draft
reply. The amount of
work that had to be
done in the Secretariat
sufficiently accounts
for the delay apparently.

R.S.
To W
R wishes this
sent for your initials
R.S. 5/9

22
with reference to note
overleaf. W.S. thinks it
would now be better to
keep letter to India back
until Monday 11th
when he intends to be
in office.

9-9-82
To R
The final revised
proof telegraphed for
on Friday evening
have not arrived.
The papers are otherwise
ready for issue, and
can be checked on
passing through the
Madras office.

R.S.
11-9
Have kept a
copy of E.R.'s note
Fair copy of letter re
issued - 11/9

Enquiries of the Council a
day he still continues

C. A. W.

any good - So
soon as we can
have details re-
solving the delays
the letter on H.R.
whether it can be
drafted

23.5.82
To R
Please see draft
reply. The amount of
work that had to be
done in the Secretariat
sufficiently account to
for the delay apparently.

R.S.
5/9
To W
R wishes this
encl. for your initials
R.S. 5/9

22
With reference to note
overleaf. W.S. thinks it
would now be better to
keep letter to India back
until Monday 11th
when he intends to be
in office.

9-9-82
To R
The final revised
proof telegraphed for
Friday evening
have not arrived.
The papers are otherwise
ready for issue, and
can be checked on
passing through the
Madras office.

R.S.
11-9
I have kept a
copy of E.R.'s note
fair copy of letter re
issued - 11/9

Discharge of the Clerk's
duty has still continued

To R

The fair draft
marked "Special" was
circulated to the
Hon. H. E. Sullivan yester-
day, and has now
yph. returned. The
letter to India can
be issued as soon as
the draft has been
received back finally
approved. but it
will have to go
through Madras
in order that the
altitudes may be
revised in accordance
with the final
done "proof" passed by
the Hon. H. E. Sullivan. Should
we receive a copy
of this final "proof"
before the letter is
ready for issue, the
altitudes can be
checked here.

T.O.

R.S. 21

W. H. Nordmann
Left at Latakona saddle
Height 1346 feet.

Will make necessary
correction in my note
soon received from you
according to request.
Sent this day.

Please send fair copy
thereof soon. If not
already sent.

Also please return
my large map, if
completed.

8-9-12

1-40 N. M.

C. A. W.

To R

Fair copies of
drafts sent this
morning

instrument of the same
duty be still continued

morning.
 To R It would appear
 from this telegram
 that Mr. Ardman
 has corrected the
 altitudes in the
 day "Proof" sent to him
 and which are
 now being passed
 is through the Press
 at Madras.

re I have telegraphed
 to Madras for a
 copy of the final
 revised "proof" to
 be sent up as
 soon as ready. It
 should be here by
 Monday at latest.
 Your map on
 Rollers is sent
 herewith.

To W From above RS
 I gather that letter
 to India will not
 be despatched until Monday
 as I do not know of this
 as yet.

INDIAN TELEGRAPH.					Local No.
Class.	X S				209
To (Station)	Ootacamund				From (Station) Bellary
Words.	Day.	Hour.	Minute.	OFFICIAL INSTRUCTIONS.	
27/4	8.	11.	29	X	
To (Person)	C. E. P. R.				From (Person) Ardman
Correct		height		of	
Sattikona		1346		feet -	
Thirteen		other		figures	
all		approximate		have	
only		corrected		in proof	
been					
Recd. By	L. N.		Sent to		L. N.
At	Hrs.	Mts.	By	At	Hrs.
				J. A. M. Telegraph Master	
Date OOTACAMUND					

dist. in still continued

To W
The accompanying
Parcel - just received -
apparently contains
Mr. Nordmann's Reports.

R.S.

Some 2/9.

Remember the
papers which had
been sent at
once to London

Will please be under
copy of uncorrected
proof to allow of
the resume being
doubled on the model
of the Bengal memo

Ott

2/9/82

To S.A.W.

Herewith Mr.
Nordmann's Reports -

Enquiries of the Circle a
day or two still continues

Proofs corrected by
himself. Have the
corrections carried
thru' the Press all
over and await
further orders as to
striking off. But
meanwhile a few
copies of the revised
"proof" might be
sent to Bury for
reference.

N.S.
2/9
Rev 5/9

Proofs sent
to Bury 5/9/88

It even will
be sent part
the letter in the
form we must
have something
on record
W.R.

Rev. H. E. Sullivan
Rev. H. E. Sullivan

For order of

The delays which occurred
in getting out Mr. Widdowson's
diaries have certainly been
most annoying and I
admit that to I have
reason to complain -

The Press unfortunately
our urgent demands have
blatantly failed us - we could
not get the 'proofs' which
required Mr. Widdowson's
corrections, and I have not
even yet received ^{the} ~~them~~ ^{diaries}
this they are promised
in a day or two -

Mr. Widdowson himself
too has been unable to
perform all his work
in final reduction of
American drafts preparation
of plans and sections &c.
In fact scarcely had he
left to Bullary from the
paucity of detail. I was
compelled to put him
in also to act as Deputy
Engineer of the Circle &
duty he still continues

Oct 22/88

to discharge in addition
to those of Executive
Engineers - he was thus
quite overwhelmed by
work - and has con-
-over I believe been in-
-disposed

This is always the
fate of our under-manned
Establishment which on
the application of any
extra pressure must
break down

I have explained all
this semi-officially to
Colonel Turner in reference
to his present letter
and therefore perhaps
the Govt. may consider
it sufficient to merely
send a brief reply in
the terms of the annexed
draft?

Attt

21/8/02

I do not think
Set one for
C. C. [unclear]
in the office [unclear]
How do we know
[unclear]

Draft

To Sect. Works - India

Sir

In reference to
your letter No 632 R
of the 12th inst. in re-
sult of the report of
the results of the recon-
-naissance undertaken
with a view to decide

the best line for a
Railway between the
District of Vizagapatnam
and Raipur in the
Central Provinces I
am directed by the
R. H. C. to I in C to
enforce his report but
owing to circumstances
needless now to enter
into, but which were
beyond the control
of this Government, the
report has been un-
avoidably delayed

No. No. This
will not do. State
them clearly. The
letter may go to
R. S. S.

Cu 22/8

PUBLIC WORKS DEPARTMENT

UNDER date the 13th Sept 1882.

Read the following:—

*L^d from Chief Commissioners
Central Provinces, M.B. (" " 9059 of 16th ")*

As _____ do _____ (" " 20 B of 4th December -)

So ————— do ————— (" " 27 Kap 14. " " "

to _____ d. _____ (" " 38K of 15th July -)

So _____ do _____ (" " bo W of 30th March "

So _____ do _____ / " " 72 May 14th April -

— 70 — do — (" " 74 Waf 18th —)

Note by the Consulting Engineer
for Railways ——— } (" ——— of " Sept —)

Letter from the Govt of India (" " 692 cc of 12th Augt. ")

Ordered that the

No. 2367 w.

Government of Madras,

PUBLIC WORKS DEPARTMENT.

To

The Secretary to the

*Government of India
P.W. Department*

Colacamund, Sept. 13th 1882

SIR,

*With reference to your letter
No 692 R.C. of 12th August 1882, on
the subject of the report of
the results of the reconnaissance
undertaken with a view to
decide the best line for a
railway between the littoral
of Vizagapatam and Raipur
in the Central Provinces, I
am directed by the Rt. Honble.
the Governor in Council to
express regret at the delay
which has occurred in
laying the results before
the Government of India.*

The following explanation will show that this has been unavoidable. Owing to the numerical weakness of the Establishment, the officer who conducted the investigations had, immediately on his return from Vizagapatam, to be placed in Executive charge of a Division and in addition he had temporarily to carry on the current duties of the Superintending Engineer, so that he had no time to elaborate his original reports which were necessarily submitted in the first instance in a somewhat crude form. In consequence, the task of passing the reports through the press, correcting the proofs and calculations of altitudes, marking the routes and preparing detailed statements in a tabular form of the particulars given in the various sections, devolved on the Chief Engineer's Office,

8/15
already overburthened with the current work of the Department. The papers had afterwards to be sent to Bellary, in view to their final revision by Mr Nordmann, from whom they have just been received.

2. In order to avoid further delay, I am directed to forward herewith copies of the printed reports, etc, together with a brief note thereon by the Consulting Engineer to this Govt. In doing so, I am to explain that the papers in question are now under the consideration of this Government, and that their views thereon shall be forwarded at the earliest possible date.

Introduction to the Reports.

Letter from Mr. Nordmann N. 114 R of 16/11/81.

Letter from Chief Commr. P.W.D. Central Provinces N. 9059 of 16th Nov. 1881.

Letter from Mr. Nordmann N. 190 of 26/11/81.

do do N. 20 B of 4/12/81.

do do " 24 R of 6/1/82.

do do " 27 R of 14/1/82.

do do " 38 R of 25/2/82.

do do " 60 W of 30/3/82.

do do " 72 W of 14/4/82.

do do " 74 W of 18/4/82.

Statement of particulars & Section W.

Brief note by Commr. Eng.

Route map.

8.9.82. W

No. 2367 w

Government of Madras.

PUBLIC WORKS DEPARTMENT.

To

*The Secretary to the
Government of India,
P.W. Department.*

13th September 1882.

SIR,

*With reference to your letter
No. 692 R.C. d/ 12th August 1882
on the subject of the report
of the results of the reconnais-
sance undertaken with a
view to decide the best
line for a Railway between
the littoral of Vizagapatnam
and Raipur in the Central
Provinces, I am desired by
the Right Honble the Governor
in Council to express regret
at the delay which has
occurred in laying the matter*

*old 8/9
Cir: 8/9 R 9/9*

before the Government of India. This however has been owing to circumstances over which there has been no control. The state of the Establishment did not admit of the officer entrusted with the investigations being detached to complete the elaboration of his original reports which were necessarily sent up in the first instance in a somewhat crude form.

So far from his being able to devote any time to this work he had immediately on his return from Vizagapatnam to be sent on to Bellary where in addition to his Provisional charge, the current duties of the Supt Engineer had to be taken up

by him. The work of passing the reports through the Supt, correcting the & calculations of proofs, ~~revising~~ ^{revising} altitudes by subsequent observation, marking the routes, and preparing detailed statements in a tabular form of the particulars given on the various sections devolved therefore on the Chief Engineer's office, and had to be performed in addition to the already heavy current duties of the Establishment. Finally the papers had to be sent to Bellary in order that Mr. Nordmann might have an opportunity of reviewing them and inserting English equivalents of vernacular

terms and giving Botani-
cal names to the various
natural products mentioned
by him throughout his notes.

It is hoped however that
all needful papers and
sections ^{being shortly} will be placed in
the hands of the Government
of India ^{so as to} ~~in sufficient time~~
to admit of this much
desired work being pushed
on during the coming cold
season.

OTTO

5/9/82

ms des ad
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despis 25/9
S. G
des ad
27/9.

R.S.
1892

x x x 38 x x
The papers had afterwards
to be sent to Bellamy, in
view to their final revision
by W. Nordmann, from
whom they have just
been received.

In order to avoid further
delay, I am directed to
forward herewith copies
of the printed reports, &c,
together with a ^{very} note
thereon by the Consulting
Engineer to this Govt.

In doing so, I am to
explain that the papers
in question are now
under the consideration
of this Govt., and that
their views thereon shall
be forwarded at the
earliest possible date.

6-9-82

lll.

The Hon. W. C. Sullivan

Rough draft
of the fair copy

7-7-96 V S

1-11-07

27-1-31 B.M.

Gobt of (1882) Madras
PUBLIC WORKS.

Dated

2366-2367
13-9-1882

G.O. 13th Sept No. 2368
2367

Nos. 89/091

Vijaya p. palau-Ranjit
Railway.

Repts on the
Ordnance to be forwarded to the
Govt. I to

do do
For the ^{with remallts} reports
of the recd. in the
for the