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MADRAS RECORD OFFICE

Government of Madras

Public Works DEPARTMENT

G.O. No. / B.P. No.		Press / Mis.
284-6 290	499	
Dated	13 . 3 .	18'18 .

Not to be folded or roughly handled

Read the following papers:—

No. 287. From the Superintending Engineer, 8th Division, to the Secretary to Government, Public Works Department, dated Madura, 10th July 1872, No. 1,645.

In acknowledging receipt of G. O. of the 20th June 1872, No. 1,519, intimating that "the services of Lieutenant Greer, R.E., will be available for the trace and survey and estimate of the Goodaloor Ghaut" on his return from privilege leave, I have the honour to observe that, in paragraph 8 of my letter No. 263, dated 20th April 1872, printed in G. O. of the 14th May 1872, No. 1,326, I have pointed out that the trace of the new ghaut has already been made by Lieutenant Rawson, R.E., and that the estimate for the same has been submitted to Government by Mr. R. Smith.

2. Moreover, in paragraph 2 of G. O. of the 14th May 1872, No. 1,325, the Government remark that "it is desirable that the road from Cumbum to the top of the ghaut should be completed as early as possible, as rapid progress appears to have been made on the part of the Travancore Government on the road from Travancore to the Madura frontier."

3. Under the above circumstances, I propose to start the ghaut work on the return of Lieutenant Greer, R.E., from privilege leave, and I trust that the Government will approve of this proposal.

No. 211.

Memorandum.

The Chief Engineer has the honour to observe, with reference to Lieutenant-Colonel Roberts' letter No. 1,645 of 10th July, that in Mr. R. Smith's report on the Perryaur Project the expression is used "when the line has been regularly traced;" which taken in connection with the words "Lieutenant Rawson's section" in letter printed with G. O. No. 1,325 of 14th May, leads him, in the absence of any survey of the ghaut, to require further documentary assurance that the line chosen and estimated for is a satisfactory one; and of the necessity of such further assurance the Chief Engineer is convinced by the statement of the lengths of the ghaut and road as projected. These are—

	M.	F.	YDS.
Length of ghaut	4	0	135
Road below	5	5	19
Total...	9	5	154

From which he comes to the conclusion that Lieutenant Rawson's ghaut section consists of a series of zigzags whose beginning and end nearly coincide with those of the old Native Ghaut.

Now, a zigzag ghaut is the rudest and least satisfactory that can be made, and should not be adopted unless natural obstacles utterly preclude a clear run from the ghaut head (which must be a fixed point) in the direction aimed at, so that the foot of the ghaut may be thrown as far out into the low country as possible. And, as none of the officers employed upon the work are known to have had any experience in ghaut tracing, the Chief Engineer must request that no work shall be undertaken until he has been supplied with a survey of such ghaut trace (together with th existing ghaut road) as shall have been inspected and approved of by the Superintending Engineer himself.

The Chief Engineer has also to remark, with reference to the estimates, that an average of Rupees 16,000 a mile for a ghaut only 16 feet wide is heavier than that of any work of the kind hitherto carried out in the Madras Presidency, excepting the new Coonoor Ghaut, the side slopes of which are unusually steep and rocky. He must, therefore, decline to submit the estimates already sent in for sanction, and request that revised ones may be made after a trace has been cut one yard wide within the level pegs, for which an advance of Rupees 2,000 out of the allotment of Rupees 20,000 is approved.

(Signed) G. W. WALKER, Colonel, R.E.,
Chief Engineer, P.W.D.

No. 288. Endorsement of the Superintending Engineer, 8th Division, dated Courtallum, 4th September 1872, No. 2,544.

From Captain J. PENNYCUICK, R.E., Executive Engineer, Dindigul Range, to the Superintending Engineer, 8th Division, dated Camp at Cumbum, 18th August 1872, No. 291.

I HAVE the honour to forward a plan of the trace proposed for the Goodaloor Ghaut.

One Plan of the Trace.

2. The work has taken rather longer than I had expected, as the ground was very difficult for the last 500 feet, and Lieutenant Rawson's trace, although following the same general line as that now adopted, was not found so useful as I had hoped. At the beginning and end especially it seems to have been rather hastily and not very judiciously made.

3. The general direction of the ghaut is, of course, governed by the valley of the Moollya-Panjaur, the stream by which the water of the Perryaur will be carried to the Sooroolly. This stream has only a slight fall at first, and the ghaut runs along its right bank; it then crosses the stream (at C. on the plan) and follows the left bank for a short distance, the ground on the right bank being very difficult. A line was run for some distance with a view to ascertaining whether the road would be continued on this bank, but not only is the ground very difficult indeed, but it is evident that the foot of the ghaut would come out much further from Goodaloor than would be the case by crossing the stream. The stream is therefore crossed again at D, and the road continued along its right bank until stopped by the large ravine at E; a return is necessary here in order to get down to a convenient level for crossing this ravine. The latter, in point of fact, governs the position of the foot of the ghaut, as it would be impracticable, except at an enormous expense, to cross it above the level chosen. The length of the zigzag has been adjusted with a view to getting the best positions for the returns.

4. I have been over the whole of the ground with Lieutenant Greer and am convinced that the line taken is the best possible.

5. Owing to the fact that no proper ghaut tracer was procurable in either the division or the range office, all the surveying has had to be done with the level and compass. Over uneven ground it is very difficult to preserve the right proportions between fall and distance, and this will account for the fact that the line surveyed deviates in some places from the intended trace.

6. You will see that the end of this trace comes out nearly a mile nearer to Goodaloor than that of Lieutenant Rawson's, and the ground between it and the village is very much more favorable.

* * * * *

9. Formally this ghaut is only a portion of the general line between Madura and Travancore by the Cumbum valley, but it is quite impossible for me to consider it separately from the Perryaur project, and it is especially with regard to this project that delay in the execution of the ghaut seems so inexpedient. I fear it will, under any circumstances, be impossible to complete the road from the head of the ghaut to the Perryaur during this season, but if the ghaut itself be completed, the cutting or tunnel at the water-shed can be commenced next year. I believe there is every prospect of the estimates for the project being very soon laid before the Government of India, and it would be a great pity if these estimates were sanctioned and the work still postponed on account of the ghaut not being ready.

* * * * *

FORWARDED to the Chief Engineer with reference to his memoranda, Nos. 211 and 155, dated respectively, 25th July and 15th August 1872.

3 Plans of Tracings.

(Signed) R. A. ROBERTS, Lieut.-Colonel, R.E.,
Superintending Engineer, 8th Division.

No. 113.

MEMORANDUM.

IN his memorandum No. 211 of 25th July, the Chief Engineer requested that he might be supplied with a survey of such trace of the proposed new Goodaloor Ghaut as should have been inspected and approved by the Superintending Engineer, 8th Division. The survey accompanying Captain Pennycuick's report No. 291 of 18th August, has been simply forwarded by Lieutenant-Colonel Roberts under date the 4th September, without note or comment.

From the papers submitted it appears that the Chief Engineer rightly conjectured Lieutenant Rawson's trace to have commenced and ended at the head and foot of the old ghaut. The new trace is a great improvement on the first no doubt, as regards throwing the foot of the ghaut nearly 1,300 yards nearer Goodaloor, while the ghaut itself is actually a few yards shorter than that first projected.

The Chief Engineer accepts, on Lieutenant-Colonel Robert's responsibility, the trace as now laid out by Captain Pennycuick and Lieutenant Greer, and directs that it be opened out as a bridle-path one yard in width to admit of the preparation of a detailed estimate for submission to Government; pending receipt of whose orders thereon it may be widened to about 12 feet, that width being about as much as can be opened in the current year with the money at present available.

Colonel Walker requests that Captain Pennycuick may be told, once for all, that the present operations on which Lieutenant Greer is employed have no connection whatever with the Perryaur project.

Orders have been sent to the Superintendent of Public Works Stores to supply Lieutenant Greer with a couple of ghaut tracing instruments of the latest pattern.

(Signed) G. W. WALKER, Colonel, R.E.,
Chief Engineer, P.W.D.

19*th September* 1872.

No. 289. From the Inspecting Engineer for Ports and Communications, to the Chief Engineer and Secretary to Government, Public Works Department, dated Chepauk, 21st January 1873, No. 18.

1 Packet, No. 1, containing 8 documents.
1 ,, ,, 2, ,, 7 ,,
1 Sketch Map, A.
1 Sketch Survey, B.

No. 1 Packet.
*1 Letter from the Superintending Engineer, 8th Division, to the Secretary to Government, Public Works Department, No. 3,723, dated 9th November 1872.
1 Copy of letter from Captain Pennycuick to the Superintending Engineer, 8th Division, No. 460, dated 24th October 1872.
1 Detailed Estimate of Goodaloor Ghaut.
1 Abstract Estimate of do. do. for Rupees 48,000.
1 Specification Report.
3 Survey Sketches, Nos. I, II and III.

With reference to your endorsement dated 11th December 1872, on the estimates for the new Goodaloor Tavalum Ghaut at the head of Cumbum valley, Madura District, and the papers noted in the margin* herewith returned, having inspected the ghaut and western and eastern approaches, etc., I have the honour to submit my report on the line for the information of Government, accompanied by a sketch map marked A of the country it passes through, as also a sketch survey marked B illustrating the ghaut itself.

2. Approach from Western Coast.—From the town of Kotyam at the head of the navigation to Cochin (which can be approached by boats drawing from 5 to 6 feet of water) to the village of Mandikyam at the foot of the Western Ghauts, a fair road of 34 miles in length has been made by the Travancore Government, the line runs through undulating country; some of the gradients are steep, but these can easily be improved. After leaving Mandikyam, the road by a well-selected line after crossing a river, draining the slopes of the hills north of the ghaut, commences to ascend the long spur of the Peeremade or Maryville Hill on its southern side by extremely easy gradients, till it reaches a low saddle on the spur which it crosses and ascends by the northern slope of the spur, and with the same gentle gradients is continued without a single zigzag to the Peeremade saddle, which it passes through by a moderate cutting, and running below the southern side of the Peeremade Hill, crosses a gorge draining a portion of the plateau above and turns northwards till it reaches the settlement of Maryville on the plateau; the whole distance is 14 miles; the ghaut has been well traced, the hill sides are very rocky and steep, and thus the work must have been a heavy and expensive one; in some places the correct slopes have not yet been worked out, but the whole line is open for traffic, and is passable for carts; the ghaut, from the precipitous character of the ground, has been left very narrow in some places, thus, before any heavy traffic can use it, it must be widened.

3. Settlement of Peeremade or Maryville Hill.—The little settlement of Peeremade or Maryville about 3,500 feet above sea level contains one of the Travancore Residency buildings and staff bungalows and some eight or ten scattered residencies belonging to coffee estates; the general aspect of the country is very like that of the western plateau and slopes of the Neilgherries.

4. Road to Perryaur.—From the head of the ghaut, a road has been traced to the Perryaur which it reaches about 300 or 400 yards above the site of the present ferry; the direction is good and the gradient easy; all the earthwork for about 3 yards in the solid has been completed, and blasting operations are in progress. I rode

over a good deal of it, but was obliged to leave it here and there, as it was not passable for horses; its length is about 11 miles; the Supervisor in charge, Mr. Sinclair, informs me that it is proposed to bridge the Perryaur at the point where the trace now terminates, and where a fine site exists for the construction of a bridge.

5. From the Perryaur to Goodaloor Tavalum.—East of the Perryaur to the head of the new ghaut at Goodaloor Tavalum, nothing but a jungle-path exists; it passes through very dense jungle, much of which off the actual pathway is quite impenetrable. The new line to connect the Perryaur road with head of the Goodaloor Ghaut is to be traced immediately by the Travancore Government, and from what I could see of the country, I believe it will run close to the present path to Tallamulla Colum and on to the Tavalum at the head of the ghaut, and that the line to the Perryaur dam will probably have to start from the point marked D in the sketch map, where the present path crosses the stream draining a portion of the valley up which the new road to the ghaut head will run. Lieutenant Greer, R.E., is just now about to investigate the country for this line, and has had 500 Rupees placed at his disposal to do so, much of this sum will have to be expended in cutting, reconnoitring paths through the forest to various fixed points of observation; no one who has not seen these forests can have any idea of their density, the difficulties that have to be overcome, and the length of time it takes in running a trace through them.

Trace to Perryaur dam.

6. Goodaloor Ghaut—Ghaut head.—The forest in the vicinity of the ghaut is so dense and high that it is next to impossible to get a good bird's eye view of the ground; but from the plains for some distance north and south of the point fixed for the ghaut head, the hills show an almost unbroken line except in two places, namely, a saddle laying about 2 miles to the south, and that selected as the ghaut head, which Lieutenant Greer informed me from known levels was 50 feet lower than the former. Through this saddle is the old track from the Cumbum valley into the Travancore country to the Perryaur, and one of the outlets from the proposed Perryaur lake into the Moollya-Panjaur stream, which drains the ghaut valley it is proposed should be cut in this saddle; taking every thing into consideration I think the ghaut head has been judiciously selected.

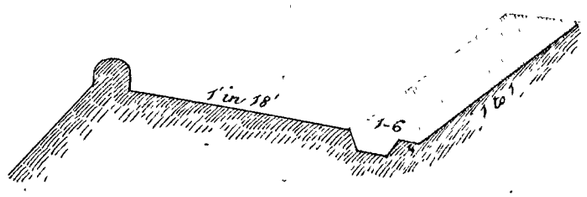
7. New Trace.—The trace throughout has been cut to a width of 4 feet in the solid so far as earthwork is concerned, but the rock has not yet been removed; numerous trial-pits or excavations have also been cut to the full width contemplated for the ghaut by the estimate, and while they give a very good idea of the work to be done, show the care with which the estimate has been prepared by Lieutenant Greer. A trial trace was made on the left bank of the Moollya Panjaur, the ghaut stream which was abandoned in consequence of the ground there being much too broken and intersected with short deep ravines, most expensive to cross and not in any way tending to ease the slope; the trace therefore now runs down the right bank of the stream till it reaches a favourable spot for crossing it, which is compulsory, as the ground below the crossing is too rocky, precipitous, and cramped to allow of the trace being continued on the right bank of the stream; to avoid too near an approach to the steep banks of the stream and a deep cutting through the saddle at the point A shown in the sketch survey marked B, the road starts with a slight rise of 1 in 50 for a distance of 600 feet, then the ghaut commences to fall 1 in 50 for 600 feet more, and then runs on 1 in 25 for a further distance of 1,750 feet to the bridge site, which is necessarily a

fixed point for the reasons already given ; from this point to the foot of the ghaut, the trace falls steadily at 1 in 16, and by three zigzags with a total length of a little over 4 miles reaches the foot at a distance of about 5 miles from the village of Goodaloor. I walked over the whole of the trace, most of it twice, carefully examining the features of the ground, and I am satisfied that it is the most economical line that could be selected ; a continuous line without zigzags, though quite feasible and viewed at a distance most tempting, could not, I believe, be carried out under double the amount of the present estimate. At the first zigzag, I reconnoitred the ground for half a mile beyond it (a good idea of its nature may be formed from the fact that it took Lieutenant Greer and myself nearly two hours to scramble over this distance) here, Lieutenant Greer made three trial traces but with the same result, namely, that he could not pass the obstacles that present themselves except at a heavy cost, the whole hill side being very rocky and precipitous, thus the first zigzag is forced, the second also for the same reasons, *i. e.*, a heavy rocky nullah with much sheet rock on the other side, while the return line to the third zigzag is continued to such a length as is necessary to preserve the gradient and throw the foot of the ghaut well into the plains.

8. Work done on the Ghaut.—Where completed, all the work has been neatly and carefully executed. In addition to the trace the earthwork of the ghaut from the head, to the first bridge and from the last zigzag to the foot, has been cut to the full width allowed for in the estimate. From the head of the ghaut to the first zigzag but little blasting is required, but below this turn is some heavy rock cutting, blasting operations have been commenced and appear to be well supervised.

9. Slopes to Side Cuttings.—*Item* 3 *of the specification* allows of all side cuttings being sloped at one to one, the general character of the soil met with on the hill side is so firm and stable that I consider such work unnecessary, which is fully proved from the present state of the trial excavations which though perpendicular, except in one or two places, show no signs of slipping, although they have been exposed to a heavy monsoon, I therefore believe the estimate may in reference to this item alone be reduced by at least 5,000 Rupees. Lieutenant Greer, pending further instructions, has therefore at my suggestion deferred this sloping till next season.

10. Drain along the inside edge of the Ghaut.—*Item* 8 *in the specification*. Though good authorities approve of this small drain, my own experience is that such a drain is a constant source of danger, often cutting into deep holes or becoming choked up with leaves, road refuse, etc., etc., turns the drainage into the road, injuring instead of protecting it, I grant that when first cut, it looks neat and effective, but the edges are soon trodden down by bullocks. Once traffic commences on the ghaut and thus requires constant attention in clearing, etc., while it will give the road a ragged and unfinished appearance; the under drains being never more than 300 feet apart, will, I think, drain the road quite sufficiently, and



+ so far from cutting a drain in the locality indicated, (see sketch in the margin) I would advise the ground at the toe of the cutting if found to be eroded by the surface drainage, being metalled

and well tamped ; the actual amount noted in the estimate for this inside drain, namely, Rupees 229, does not represent the saving that would accrue from dispensing with it, which would be tantamount to reducing the width of the earthwork of the ghaut by at least 18 inches, for, say, over a total length of 3½ miles, and this will effect a considerable reduction in the estimate. Under the circumstances noticed, which I pointed out to Lieutenant Greer until orders are passed on this report, this work will also be deferred till next season.

11. Road Surface.—I noted that the completed portion of the surface of the road has an inward slope of 1 in 18, which arrangement I have not found to answer. I prefer a barrelled road-way which when metalled, in my opinion, answers much better than sloping the surface all one way, the objection raised, namely, the difficulty of getting rid of half the surface drainage, is easily overcome by making escapes for it over the mouths of the drains.

12. Water Tables.—*Item* 10 *of the specification.* On a ghaut comtemplated to be so well provided with under drains, water tables are of little or no use, while they are a great hindrance to cart traffic ; I, therefore, do not recommend their construction.

13. Planting Slopes.—*Item* 7 *of the specification* I deem unnecessary, as the slopes will soon clothe themselves.

14. Catch Drains.—A good deal of the catch drain adjacent to the earthwork completed has been taken in hand, the portions finished appear to be good and of ample section.

15. Under Drains.—It is contemplated by the estimate that all under drains should be built of stone in mortar. Roughstone without mortar is, I think, all that is wanted for the smaller tunnels; the larger ones alone being built of rubble masonry. The masonry foundation of a tunnel with two vents on the lower portion of the ghaut was being built when I visited the work, the masonry appeared strong and good.

16. Bridge Estimates.—While at Goodaloor Tavalum, the District Engineer of Madura furnished me with the plans and estimates noted in the margin, for the bridges on the ghaut and for continuing the road from the foot of the ghaut to the village of Goodaloor, to which a sanctioned road is already under construction from Pariacolum. The specification for the ghaut does not give the positions or details of the spans of the various bridges on the ghaut. The abstract estimate for the ghaut notes the following entry :—

Packet No. 2.
3 Plans for masonry works.
1 Estimate (detailed and abstract) for masonry works.
1 Detailed Estimate for the road.
1 Abstract do. for do.
1 Specification.

1 Timber Platform Bridge of 50′ span, No. 4	1,200	0	0
3 Bridges, Nos. 1, 3 and 5, of 25′ span with timber platform, at 500 Rupees each	1,500	0	0
4 Bridges, Nos. 2, 6, 7 and 8, of 15′ span with timber, at 300 Rupees each	1,200	0	0
For eight bridges a total of	3,900	0	0

including one bridge of 50′ span, while the general abstract has the bridges entered differently, namely:—

On ghaut.

								RS.	A.	P.
1 Bridge of 25′ span										
Do. of 25′ do.	...	...	...	...	...	...		1000	0	0
Do. of 15′ do.	...	...	...	...	...	...		650	0	0
	...	...	...	...	...	...		380	0	0
							Total...	2,030	0	0

No mention is made of a bridge of 50′ span, which I presume is not required, some confusion on the subject evidently exists which demands explanation, and the sites, span, and cost of each bridge, should be separately specified.

17. Though as designs for bridges those submitted are all that can be desired and have been carefully prepared, I think they are unnecessarily elaborate and it will be difficult to construct them at Goodaloor.

18. On the survey sketch of the ghaut prepared for me by Lieutenant Greer, R.E., the sites and spans of the bridges are given; Nos. 1, 3 and 4 being only of 25′ span, these might be more easily and cheaply constructed by using simple balks resting on cantilevers projecting 5 feet from the abutments, strutted, or simply bolted to the upper balks by two $\frac{3}{4}$″ iron bolts, etc., etc. Bridges Nos. 2, 6, 7, and 8 being only 15′ span require no cantilevers.

19. The roadway provided, namely, 15 and 16 feet, appears to me to be greater than required, 12′ being quite sufficient for all practical purposes, the plans and estimates for the bridges should, therefore, be revised, provision being made for timber girders where necessary on cantilevers 12″ × 10″ with joists 6″ × 4″, 2 feet from centre to centre, covered with 2 inch planking, the whole being gravelled or metalled, fixed hand rails would be likely to be damaged by the wild elephants which frequent the ghaut. A mere bamboo railing which could be easily renewed if damaged is all that is wanted.

20. Lieutenant Greer informed me that it was proposed to construct a bridge of 25′ span over the nullah marked as the site of bridge No. 5 in the sketch survey of the ghaut; the nullah is very broad though shallow, and I consider can be much cheaper and safer crossed by an ordinary road dam for which provision should be made in the revised estimate.

21. The road from the foot of the ghaut to the village of Goodaloor, a distance of 5 miles, has been laid out; the estimate for it enclosed, has not, I believe, yet been before Government. I have no remark to make regarding it, with the exception that I believe a solid teak-wood queen post truss bridge like that constructed on the Coonoor Ghaut, is a more suitable structure than that designed for the Vyravenar, the plan and estimate for which, I recommend, should be revised accordingly. My remarks in reference to the bridges of 25′ span on the ghaut apply also to the bridge over the Oodiaputty tank channel.

22. The road from Goodaloor, *via* Cumbum to Pariacolum at the foot of the Pulney Hills, is now being re-constructed, and will probably be completed by the time the ghaut is ready for traffic.

23. Pariacolum is connected by a fine road with Madura, 15 miles on this road at Balagoonta a line to Dindigul is also being re-constructed.

24. Camp at Goodaloor Tavalum.—The camp is well situated on high ground, well ventilated close to the head of the ghaut. About 150 feet above the ghaut

Proceedings of the Madras Government, Public Works Department,
13th March 1873.

stream, the huts are roughly constructed of bamboo and thatch, the walls also being of grass; the cold damp night air blows freely through them, and thus the liability of their occupants to jungle fever is, I consider, much increased. Lieutenant Greer, while I was with him, was even at this early period of the year, threatened with an attack which was only stoned off by large doses of quinine; it appears to me to be very desirable that the Executive Officer should be provided with good quarters; a wooden hut with corrugated iron roof, with out-houses, enclosed in a timber kraal sufficiently strong to keep out elephants, would add much to his comfort and the chance of keeping his health, while it would subsequently be a useful building as a travellers' bungalow which is much required in this wild uninhabited country. At present, to keep off the troublesome elephants, it is found necessary to have a large fire kept alight during the whole night, attended by two watchmen, which costs 250 Rupees per working season; if a protected building of the description proposed were constructed, this amount would be saved, the cost of the bungalow, etc., might be met from the savings likely to be made on the estimate as already pointed out by me.

25. Medical Attendance.—I noted what appeared to me to be a very great want to Lieutenant Greer, working as he is, with a large body of workmen, in so unhealthy a locality on a description of work on which, though every precaution be taken, occasionally accident must occur, namely, that he has no medical aid nearer than Madura or Dindigul, and I would strongly urge the necessity of either an Apothecary or a first-class Hospital Assistant of some ability being attached to his camp during the working season. Lieutenant Greer informed me that, with the exception of the lascars, he does not require the establishment sanctioned for his use; the pay of this establishment would, therefore, be made better use of in meeting the cost of a medical subordinate, which it will more than cover.

26. Superintendent Mr. Jones.—Lieutenant Greer brought to my notice the valuable Assistant he has in Mr. Jones, his Ghaut Overseer. Hitherto this man has drawn pay only during the working season, after which he remains without employment till it commences again. I now understand that, if some departmental employment is not found for him when the work stops, he will probably seek work in some other department, and his services, which are most useful on the ghaut, be lost. I therefore recommend that his case receives consideration and arrangements be made to retain his services.

No. 290. Order thereon, 13th March 1873, No. 799.

CIVIL WORKS, No. 18.

His Excellency the Governor in Council has received with satisfaction the report of the Inspecting Engineer for Ports and Communications, showing that a creditable trace has been made down the Goodaloor Ghaut, throwing its foot nearly a mile further down the Cumbum Valley than that of the old ghaut, and with a gradient no where exceeding 1 in 16.

2. He approves of the suggestions for altering the cross section of the ghaut contained in paragraphs 9, 10, and 11 of Lieutenant-Colonel Farewell's

report. They are in accordance with the practical experience of years past on the Neilgherries, Wynaad, and Western Ghauts generally; as are those of paragraphs 12, 13, and 15, proposing to dispense with water tables, planting of slopes, and the use of mortar in the masonry of minor drains.

3. The District Engineer will instruct Lieutenant Greer to revise the estimates accordingly, including those of the bridges below 30 feet span, of which the Inspecting Engineer will supply a standard plan. A building for the eventual use of travellers, but primarily for accommodating the officers and subordinates attached to the Goodaloor Ghaut and Perryaur Works, should be planned and estimated for. It is not thought advisable to restrict the width of roadway over the bridges to 12 feet, or dispense with stout railings, as proposed by the Inspecting Engineer; and as it may be convenient to carry out the 70 feet bridge over the Vyravenar, as planned by Captain Pennycuick, in scantlings, the carpentry of which can conveniently be executed in a healthy locality and carted to the spot, that design may stand; unless Lieutenant-Colonel Farewell's 70 feet truss, of which he will send a drawing, be preferred.

4. Provision should be made under the head of Petty Establishment for the services of a medical subordinate. The Ghaut Overseer can be similarly provided for, his services being utilized on the roads of approach now in progress below when the ghaut works themselves are at a stand still.

5. Pending sanction of final estimates, the cost of the ghaut and road below to Goodaloor will be taken at Rupees 60,000, whereof Rupees 20,000 being the current year's allotment, the balance will be available from the 1st April.

(True Extract.)
(Signed) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

To the District Engineer, Madura.
,, Inspecting Engineer for Ports and Communications.
,, Financial Department.
,, Controller of Public Works Accounts.
,, Revenue Department.

Exd. E. C. Shunker.

P. W. 15

No 18

Office of the Inspecting Engineer for Ports & Communications
Madras. Chepauk
21st January 1873.

From
Visit.t Colonel H. T. Farewell
Inspecting Engineer for
Ports and Communications.

To
Colonel G. W. Walker C.B.
Chief Engineer and Secretary
to Government P.W.

Sir,

Enclosure -
1 Packet-No1 containing 8 documents. A
1 Do. No2. Containing 3 documents B
1 Sketch Map A
1 Sketch Survey B

No 1 Packet-
1 Letter from the Supt Engr 8th Dec to the Secretary to Govt P.W.D. No 3723 dated 14th December 1872.
1 Copy of letter from Capt Pennycuick to the Supt Engr 8th Dec No 4460 dated 24th October 1872.
1 Detailed Estimate of Goodaloor Ghaut
1 Abstract Estimate of Do for Rs 48000.
1 Specification Report
3 Survey Sketches Nos 1. 2, 3.

With reference to your Endorsement dated 11th December 1872, on the Estimates for the New Goodaloor Tavalam Ghaut at the head of Cumbum Valley, Madura District, and the papers noted in the Margin, herewith returned, having inspected the Ghaut and Western and Eastern Approaches I have the honor to submit my Report on the line for the information of Government, accompanied

by a sketch Map marked A. of the country it passes through, as also a sketch survey marked B illustrating the Ghaut itself.

Approach from Western Coast.

2. From the town of Kotyam at the head of the Navigation to Cochin, (which can be approached by Boats drawing from 5 to 6 feet of water) to the Village of Mundikyam at the foot of the Western Ghauts, a fair Road of 34 Miles in length has been made by the Travancore Government. the line runs through undulating country, some of the Gradients are steep, but these can easily be improved. After leaving Mundikyam, the road by a well selected line after croping a river, draining the slopes of the hills north of the Ghaut, commences to ascend the long spur of the Peeremade or Maryville Hill on its southern side by extremely easy Gradients, till it reaches a low saddle on the spur which it crosses and ascends by the Northern slope of the spur and into the saddle gentle Gradients is continued, without a single zig zag to the Peeremade saddle, which it passes through by a moderate cutting, and running below the southern side of the Peeremade hill, crosses a gorge draining a portion of the plateau above and turns Northwards till it reaches the settlement of Maryville on the plateau; the whole distance is 14 Miles; the Ghaut has been well traced, the hill sides are very rocky and steep and thus the work must have been a heavy and expensive; in some places the correct slopes have not yet been worked out, but the whole line is open for traffic and passable for carts; the Ghaut, from the precipitous character of the ground, has been left very narrow in some places, thus, before any heavy traffic can use it, it must be widened.

Settlement of Peeremade or Maryville Hills.

3 The hills settlement of Peeremade or Maryville about 3500 feet above sea level, contains of the Travancore Residency

Buildings and staff Bungalow and some eight or ten scattered residences belonging to Coffee Estates; the general Aspect of the country is very like that of the Western Plateau and slopes of the Neilgherries.-

Road to Perryaur

4. From the Head of the Ghaut, a road has been traced to the Perryaur which it reaches about 300 yards above the site of the present Ferry; the direction is good and the gradient easy; all the earth work for about 3 yards in the solid has been completed, and blasting operations are in progress. I rode over a good deal of it, but was obliged to leave it here and there, as it was not passable for horses, its length to about eleven miles, the Superviser in charge, Mr. Sinclair, informed me that it is proposed to bridge the Perryaur at the point where the trace now terminates and where a fine site exists for the construction of a bridge.

From the Perryaur 5, East of the Perryaur to the head of the New Ghaut at Goodalore Tavalum, nothing but a jungle path exists, it passes through very dense jungle, much of which off the actual pathway is quite impenetrable. The new line to connect the Perryaur road with head of the Goodalore Ghaut is to be traced immediately by the Travancore Government, and from what I could see of the country, I believe, it will run close to the present path to Tallamalla Column and on to the Tavalum at the head of the Ghaut and that the line to the Perryaur down will probably have to start from the point marked D in the Sketch map, where the present path crosses the stream draining a portion of the valley up which the new road to the Ghaut head will run. Lieut. Green R.E. is just now about to investigate the country for this line, and has

Goodalore Tavalum.

Trace to Perryaur Down.-

had 500 Rupees placed at his
disposal to do so, much of this
sum will have to be expended
in cutting, reconnoitring paths through
the forest to various fixed points of
observation; no one who has not
seen these forests can have any
idea of their density, the difficulties
that have to be overcome and the
length of time it takes in running
a trace through them.—

6. The forest in the vicinity of the Ghaut is so dense and high that it is next to impossible to get a good birds eye view of the ground, but from the plains for some distance north and south of the point fixed for the Ghaut Head, the hills show an almost unbroken line except in two places. Viz:- a saddle laying about two miles to the south, and that selected as the Ghaut Head, which Lieut. Greer informed me from known levels, was fifty feet lower

Goodalore Ghaut.

Ghaut Head.

than the former; through this saddle is the old track from the Cumbum Valley into the Travancore Country to the Perryaur, and one of the outlets from the proposed Perryaur Lake into the Moolliga Vaigai stream, which drains the Ghaut Valley. it is proposed, should be cut in this saddle, taking every thing into consideration I think the Ghaut Head has been judiciously selected.—

New Trace. 7 The trace throughout has been cut to a width of 4 feet in the solid so far as earth work is concerned, but the rock has not yet been removed; numerous trial pits or excavations have also been cut to the full width contemplated for the Ghaut by the Estimate, and while they give a very good idea of the work to be done, show the care with which the Estimate has been prepared by Lieut. Greer. A trial trace

was made on the left bank of the Mooltja Panjan, the Shaft abovenamed which was abandoned in consequence of the ground there being much two broken and intersected with short deep ravines, most expensive to cross and not in any way tending to save the slope; the trace therefore now runs down the right bank of the stream till it reaches a favorable spot for crossing it, which is compulsory as the ground below the crossing is too rocky, precipitous and cramped to allow of the trace being continued on the right bank of the stream; to avoid too near an approach to the steep banks of the stream and a deep cutting through the saddle at the point **A** shown in the sketch Survey marked **B**, the road starts with a slight rise of 1 in 60 for a distance of 600 feet, then the Shaft commences to fall 1 in 50 for 600 feet more

further distance of 1750 feet to the Bridge site, which is necessarily a fixed point for the reasons already given, from this point to the foot of the Shaft, the trace falls nearly all in 16, and by three zig zags with a total length of a little over 4 miles, reaches the foot at a distance of about 6 miles from the village of Goodalore. I walked over the whole of the trace, most of it twice, carefully examining the features of the ground, and am satisfied that it is the most economical line that could be selected; a continuous line without zigzags, though quite feasible, and viewed at a distance most tempting, could not, I believe, be carried out under double the amount of the present Estimate. At the first zigzag I reconnoitred the ground for half a mile beyond it, (a good idea of its nature may be formed from the face

that it took Lieut Greer and myself nearly two hours to scramble over this distance.) here Lieut Greer made three trial tracers but with the same result viz that he could not pass the obstacles that present themselves except at a heavy cost. the whole hill side being very rocky and precipitous. thus the first zigzag is forced. the second also for the same reasons i.e. a heavy rocky Nullah with much sheet rock on the other side, while the return line to the 3d zigzag is continued to such a length as is necessary to preserve the gradient and thus the foot of the Ghaut will be in the plains.-

Work done on the Ghaut

8. Where completed, all the work has been well and carefully executed- In addition to the trace the earth work of the Ghaut from the head to the first Bridge and from the last zigzag to the foot has been cut to the full width allowed for in the Estimate.-

From the head of the Ghaut to the first zigzag but little blasting is required but below this turn, is some heavy rock cutting, blasting operations have been commenced and appear to be well supervised.-

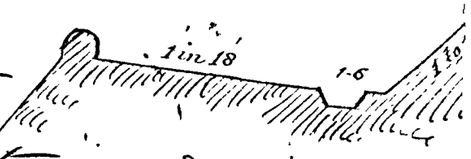
Slopes to side Cuttings.

9. Item 3 of the specification allows of all side cuttings being sloped at one to one, the General Character of the soil met with on the hill side is so firm and stable that I consider such work unnecessary, which is fully proved from the present state of the trial excavations which though perpendicular, except in one or two places show no signs of slipping, although they have been exposed to a heavy monsoon. I therefore believe the Estimate may in reference to this item alone be reduced by at least 5000 Rupees.- Lieut Greer, pending further instructions has, therefore at my suggestion,

deferred this closing till next season.-

10. Item 8 in the specification. Drain along the inside toe of the Chaut.-

Though Road Authorities approve of this small drain, my own experience is that such a drain is a constant source of danger, often cutting into deep holes or becoming choked up with leaves, road refuse &c. turns the drainage into the road, injuring instead of protecting it, I grant that when first cut it looks neat and effective, but the edges are soon trodden down by balloches. Once traffic commences on the Chaut and thus requires constant attention in clearing &c. while it will give the road a ragged and unfinished appearance, the under drains being never more than 300 feet apart, will, I think drain the road quite sufficiently, and so far from cutting a drain in the locality indicated, I should like to see the



margin.-

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Should advise the ground at the toe of cutting if found to be crossed by the surface drainage, being metalled and well tamped; the actual amount noted in the Estimate for this inside drain Vz. Rs. 229. does not represent the saving that would accrue from dispensing with it, which would be tantamount to reducing the width of the earth work of the Chaut by at least 18 inches for say over a total long tho of 3½ miles and thus will effect a considerable reduction in the Estimate.- Under the circumstances noticed which I pointed out to Dewan Sheer Mittel orders are passed on this report, this work will also be deferred till next season.-

Road Surface. 11. I noted that the completed portion of the surface of the road has an inward slope of 1 in 18, which arrangement I have not found to answer.

I prefer a barrelled road way which when metalled, in my opinion answers much better than sloping the surface all one way, the objection raised viz. the difficulty of getting rid of half the surface drainage, is easily overcome by making escapes for it over the mouths of the drains.

12. Item 10. of the specification. Water tables.
On a Shaut contemplated to be so well provided with under drains, water tables are of little or no use, while they are a great hindrance to cart traffic. I therefore do not recommend their construction.

13 Item 7. of specification. I deem unnecessary as the slopes will soon clothe themselves. Plantings Slopes.

14. A good deal of the catch drain adjacent to the earth work completed, has been taken in hand the portion finished appear to be good and of ample section. Catch Drains

Under Drains 15. It is contemplated by the Estimate that all under drains should be built of stone in mortar. Roughstone in cement Mortar is I think, all that is wanted for the smaller tunnels. The larger ones alone being built of Rubble Masonry. The Masonry foundation of a Tunnel with two vents on the lower portion of the Shaut was being built when I visited the work, the Masonry appeared strong and good.

Bridge Estimates. 16. While at Goodaloor Tanalum, the District Engineer of Madura furnished me with the plans and Estimates noted in the margin, for the Bridges on the Shaut and for continuing the road from the foot of the Shaut to the village of Goodaloor, to which a sanctioned Road is about under construction from Paria Coleum. The specification for the Shaut does not give the positions or details of the spans of the Masonry Bridges on the Shaut; the abstract Estimate

Received 1902.
3 Plans for Masonry works.
1 Estimate (Detailed & Abstract) for Do
1 Detailed Estimate for the road.
1 Abstract Do for Do
1 Specification.

for the Chaut. Notes the following
Entry.-

1 Timber platform Bridge
of 30' span No 4. —— 1200-

3 Bridges Nos 1. 3 & 5 of 25'
span with timber platt
forms at 500 Rs each — 1500-

4 Bridges Nos 2. 6. 7 & 8 of
15' span with timber
at 300 Rupees each — 1200-

for 8 Bridges a total of Rupees 3900-

including one Bridge of 30' span
while the General abstract has two
Bridges entered differently Vizt
On Chaut:

1 Bridge of 25' span — Rs 1000.
Do — of 25' — D: — 650
D: — of 15' — D: — 380.
Total Rs 2030.

No mention is made of a Bridge
of 30' span, which I presumed
not required. Some confusion on the subject
evidently exists which demands
explanation, and the site, span,
and Cost of each Bridge, should
be separately specified.-

17. Though designs for Bridges
thus submitted are all that can be
desired and have been carefully
prepared, I think they are somewhat
elaborate and it will be difficult
to construct them at Goodalore.-

18. On the Survey Sketch of the
Chaut prepared for me by Capt
Greer R.E. the sites & spans of the
Bridges are given.- Nos 1. 3 & 4 & 5
being only of 25' span, these might
be more easily and cheaply con-
structed by using simple balks
resting on Cantilevers projecting
5 feet from the abutments, strutted,
or simply bolted to the upper balks
by two 3/4" iron bolts as in Bridges
Nos 2. 6. 7. & 8 being only 15' span
require no Cantilevers

19. The roadway provided by 15 x 16
feet appears to me to be greater
than required, 12' being quite
sufficient for all practical
purposes, the plans & Estimates
for the Bridges should therefore
be revised, provision being made

for Timber Girders where practicable on Cantilevers 12"x 10" in the joint to 6"x 4" two feet from centre to centre, covered with two inch planking, the whole being gravelled, or metalled, fixed hand rails would be likely to be damaged by the wild elephants which frequent the Ghaut. a mere bamboo railing which could be easily renewed if damaged would be all that is wanted.-

20. Lieut. Speer informed me that it was proposed to construct a bridge of 25' span over the Nullah marked as the site of Bridge No 5 in the Sketch Survey of the Ghaut. The Nullah is very broad though shallow and I consider can be much cheaper and safer crossed by an ordinary road drain for which provision should be made in the revised Estimate.

21. The road from the foot of the Ghaut to the village of Goodaloor a distance of 5 miles has been laid out. the Estimate for which enclosed,

has not, I believe, yet been before Government. I have no remark to make regarding it, with the exception that I believe a solid teak wood Queen post truss bridge like that constructed on the Coonoor Ghaut, is a more suitable structure than that designed for the Gyravenar, the plan and Estimate for which I recommended, should be revised accordingly. My remarks in reference to the Bridges of 25' span on the Ghaut, apply also to the Bridge over the Goodaloor Gauk Channel.-

22 The road from Goodaloor via Cumbum to Peria Coloum at the foot of the Palney Hills, is now being reconstructed and will probably be completed by the time the Ghaut is ready for traffic.-

23 Peria Coloum is connected by a fine road with Madura, 15 miles on this road at Balagoonta, a line to Dindigul is also being reconstructed.-

24. The Camp is well situated on high ground well ventilated & close to the head of the Ghaut about 150 feet above the stream, The huts are roughly constructed of Bamboo and thatch, the walls also being of grass; the cold damp night air blows freely through them — and thus the liability of their occupants to Jungle fever &c, I consider, much increased. Lieut. Greer, while I was with him, was even at this early period of the year, threatened with an attack which was only staved off by large doses of quinine; It appears to me to be very desirable that the Executive Officer should be provided with good quarters; A wooden hut with corrugated iron roof, with out-houses, enclosed in a timber kraal sufficiently strong to keep out elephants, would add much to his comfort and the Chance of keeping his health, while it would subsequently be a useful building as a Travellers Bungalow which is much required in this

Camp at Goodalore Taxation.

6

wild uninhabited country. At present, to keep off the troublesome Elephants, it is found necessary to have a large fire kept alight during the whole night attended by two watchmen which costs 250 Rupees per working season; if a protected building of the description proposed were constructed, this amount would be saved; the cost of the Bungalow might be met from the savings likely to be made on the Estimate as already pointed out by me.

Medical Attendance.

25. I noted what appeared to me to be a very great want to Lieut. Greer, working as he is, with a large body of workmen, in so unhealthy a locality on a description of work on which though every precaution be taken, occasionally accidents must occur, viz: that he has no medical aid, nearer than Madura or Dindigul, and I would strongly urge the necessity of either an Apothecary or a first class Hospital Assistant of some

abilities being attached to his camp during the working season.- Lieut.t Greer informed me that with the exception of the Lascars, he does not require the Establishment sanctioned for his use; the pay of this Establishment would, therefore, be made better use of in meeting the cost of a Medical Subordinate which it will more than cover.-

26. Lieut.t Greer brought to my notice the valuable Assistant he has in Mr. Jones, his Ghaut Overseer. Hitherto this man has drawn pay only during the working season, after which he remains without employment, till it commences again.- I now understand that if some departmental employment is not found for him when the work stops, he will probably seek work in some other Department and his services which are most useful on the Ghaut be lost. I therefore recommend that his case receives

Superintendent.
Mr. Jones.

consideration and arrangements be made to retain his services.-

I have the honour to be
Sir
Your most Obed.t Servant.
W Hasnik Lieut.t Colonel
Inspecting Engineer for
Ports & Communications.

P. W. D. 1873 Department
Original Govt for March
No. 582.

From The Inspecting Engineer
for Ports & Communications

To The Chief Engineer and
Secretary to Government
P.W.D.

Dated 21st January 1873.
Rec'd 28th ——— .
No. 18.
Enclosures 4, (one plan)

Submits reports on the
New Goodaloor Anicut
Ghaut and Estimate
Madura district.

No. 799 - 13th March 1873.

No 289
Ltr 31st Jan 1873 & 4th Feby 1873

P. W. D.

No. 799

Proceedings of the Madras Government

Read the following:-

From.

The Supt Engineer 8th Div } (H. E. No. 37 dated 9th Nov/72)

" Supt Engineer for Ports & Communications } (" " " 18 " 21st Jany/73)

His Excellency
the Governor in Council
has received with satis-
-faction the Report of
the Inspecting Engineer
for Ports and Commun-
-cations shewing that a
Creditable trace has been
made down the Goda-
-loor Ghaut Proving
its feasibility a Mile further
down

down the Cumbum Valley
than that of the old Road,
and with a Gradient
no where exceeding 1 in 16.

He approves of
the suggestions for altering
the cross section of the
Road contained in paras
9, 10 and 11 of Lieut Colonel
Farewell's Report. They
are in accordance with
the practical experience
of years past on the
Railway Services, Highroad,
and Western Roads
generally; as are those
of paras 12, 13 & 15 pro-
posing to dispense with
water Tables & planting
of slopes, and the use
of

37/ 2

of Mortar in the masonry
of minor Drains.

The District
Engineer will instruct
Lieutenant Greer to
revise the Estimates
accordingly; including
those of the Bridges below
30 feet spans, of which
the Inspecting Engineer
will supply a Standard
Plan - a building, for
the occasional use of tra-
vellers, but primarily
for accommodating
the Officers and Subordi-
nates attached to the
Gudalore Ghaut and
Permanent Works should
be planned and
estimated

estimated for. It is not thought advisable to restrict the width of Roadway over the bridges to 12 feet, or dispense with stout railings, as proposed by the Inspecting Engineer; and as it may be convenient to carry out the 70 feet bridge over the Byrawnar as planned by Captain Kennycuick, in scantlings the carpentry of which can conveniently be executed in a healthy locality and carted to the spot, that design may stand; unless Lieutt Colonel Farewell's 70 feet Trusts, of which he will send a drawing, be preferred.

Provision should be made under the head of Petty Establishment for the services of a Medical Subordinate. The Ghaut Overseer can be similarly provided for; his services being utilized on the roads of approach now in progress below, when the Ghaut works themselves are at a stand still.

Pending construction of proper Bridges the cost of the Ghaut and Road below to Gudaloor will

will be taken at Rs 60,000
whereof Rs 20,000 being
the current years allot-
-ment, the balance will
be available from the 1st
April.

GWW

70
8

To the Dr Engr Madras
" Insp Genl for Ports & Com
munications
" Financial Asst
" Controller
" Asst Engr
" Chief Engr for Irrs
Desp 20/3/73.

x 8 Plans and Estimates
Sent to the Dy Secy Govt
for Ports & Communications
Cir No 2316/73

C/o.s 582 ~~5538~~

4 4 2/1
3 4

Govt. of [illegible] 1873 [illegible]

PU[illegible] WORKS.

To The Distrub Engineer
Madura

11-2-18 [illegible]

Dates

Recd. Encl. 17
S. Plans

G. O 13th March. No. 799.

Nos. 287 & 290

New Godalur Road.

Passing orders on
papers relating to the
New Godalur
Road.

Desp 20/3/73: