

(1) Number of pages _____

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MADRAS RECORD OFFICE.**Government of Madras.***Public works* **DEPARTMENT.**

G.O. No.	304	Press
619-620		Mis.
Dated	30-1-	1878.

Not to be folded or roughly handled

Read the following papers :—

No. 619. From the Superintending Engineer, 2nd Division, to the Chief Engineer for Irrigation, dated Bezwada, 14th June 1871, No. 29.

In reply to G. O., No. 364, 6th February, I have the honour to observe that
1 Plan. Major Mullins appears to have made
1 Data. some mistake in his memoranda

5-9
regarding the Kolakalur bridge. I have no idea where he received the rates he has given, nor can I recall to memory any discussion regarding them or the works. Lieutenant Campbell, the Range Officer, returned to Chebrole from Jagarlamudy, and the Overseer, Mr. Coghlan, met us on the spot, but he had no accounts; we proceeded to Duggirala, where we met Mr. Norris, but no word on the subject was said to him, or Major Mullins would have learned that the bridge was not, as he supposes in paragraph 9, in his charge.

2. As regards the amount of concrete, I beg to observe that Lieutenant Smith increased the quantity on finding what a slippery quick stuff he was dealing with. I regret that I did not know the Toongabuddra when I sent in the estimate as well as I do now, as I am inclined to think that the water-way should be increased. I received the papers as generally approved by my predecessors, who had far more local knowledge than I had.

3. Both Colonels Anderson and Winscom had turned their attention to the Toongabuddra, which from Duggirala to near Jagarlamudy is now flowing in its natural tortuous course. Both have had sketches prepared for alterations in form and gradient. Colonel Anderson was sanguine that some work which he commenced would tend to silt up the deep bed, and reduce the velocity of the water flowing in a wider channel; his expectations have not been, so far as I know, realized.

4. The rapidity of the stream is most inconvenient for traffic; the water rushes down to supply the cultivation below, and any decrease at Duggirala stops, or seriously hinders, all traffic in the upper miles; for this reason, and the actual deficiency of punts to carry materials, the local officers were obliged to seek for supplies in the neighbourhood.

5. I may mention, however, as a reason for my not remarking on this before, that I had contemplated carrying the navigable canal by a higher level nearer Guntoor; the whole subject will perhaps be more conveniently discussed as a part of Commamore project.

6. Major Mullins has also forgotten that I proposed personally to build the additional towing-path as a projecting bracket above water-mark. I understood that he was satisfied as to the necessity for its construction from the difficulty to boat coolies tracking on the lee bank. I trust that the Government will permit me to build it as I mention above.

7. The Toongabuddra at the point where the road crosses, and for some distance on either side, has low banks which are flooded during most part of the year. All materials were therefore necessarily stored some little distance (250 yards) from

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the actual site; if the bridge had been built in the proper bed of the canal this extra distance would have been increased by 50 yards, the work would have been also very considerably delayed by the presence, during nine months, of water for irrigation.

8. Labour is by no means easily procured, and more especially skilled labour, and Major Mullins much underrated our difficulties. The Toongabuddra is the main drain of the Western Delta; its soft sandy bed is the natural holder of a great quantity of water slowly percolating to sea; any foundation work will disturb this, and necessitate constant baling. Seven archimedean screws and gangs of men with baskets were required to keep down the water at the Commamore lock three miles off, the cost of baling on that work was Rupees 4,172.

9. I forward, on a separate paper, the prices of concrete and ashlar masonry. As regards Major Mullins' estimate of stone for Sectanagram, we have the actual cost of material delivered for the road over this very bridge Rupees 1-3 5, or 1 pie less than the average cost from our land quarries. This is a single instance where no accident happened. If from any risk to the crops on Nizampatam or Western Bank Channel the supply in the Toongabuddra had been diminished or shut off, the cost would have been much increased. In the long time this bridge has been in progress many reasons for delay must have occurred, which would prevent our assuming this as a correct rate.

10. I beg also to protest against the remark regarding the use of small stones. Mr. Coghlan, in my presence, positively informed Major Mullins that he had, under instructions from Lieutenant Smith, levelled the top course with the small stones pending the sanction of a supplemental estimate.

11. I enclose a sketch, drawn up under instructions from Colonel Winscom, showing the cuts he proposed to make; that at the site of the bridge being one. If this be omitted from the supplemental estimate the bridge will be of no use, as the old canal will bar all traffic as it does now. In my letter* forwarding the revised estimate, I observed that the cost of the cut was really debitable to the Commamore project, a remark which Major Mullins appears to have overlooked.

12. I trust that the Government will be satisfied that the excess above estimate is not unreasonable; we had not, in 1869, when the estimate was prepared, the experience acquired as to cost of carriage, baling, etc., etc., and future estimates will make due allowance.

No. 619A. From the Officiating Superintending Engineer, 2nd Division, to the Chief Engineer for Irrigation, dated Camp at Madras, 2nd August 1872, No. 67.

I SHOULD feel obliged by your kindly favouring me with the orders of Government on my predecessor's letter to your address on the subject of the revised estimate for the Kolakalur bridge in the Kistna District.

2. As the work is in progress, I trust Government will be pleased to sanction the revised estimate at an early date.

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No. 619B. From the same Officer, dated Bezwarah, 3rd October 1872, No. 101:

I HAVE the honour to acknowledge the receipt of your letter, No. 150 of 14th

1 Comparative Statement.
1 Captain Vibart's letter.

August last, and to inform you the level of the Kolakalur bridge is correct. The mistake I mentioned to you

is in a bridge lately constructed over an adjoining channel, and I have to express my regret for having misled you in the matter.

2. The expenditure on the Kolakalur bridge up to date has been Rupees 11,694-12-3, as will be seen by referring to the enclosed statement.* The wings,

* Marked A.

abutments, and piers have been built up to 11 feet above floor level, or to

within 6 inches of the springing line. The floors have been laid, and a masonry wall, for one towing-path, has been constructed. The idea of building a second path appears to have been abandoned.

3. Judging from paragraph 6 of Major Mullins' report,* and from the state of the bridge as described by the Executive Engineer in his letter of the 7th ultimo, very little, if any, work

appears to have been done since the date of the former officer's inspection.

4. The maximum velocity of the stream on the completion of the Commamore channel will be 1.85 feet per second, but it will, no doubt, be somewhat in excess of this until the regulating works have been built on that canal; but I believe arrangements could easily be made to prevent the current attaining a greater speed than 2½ feet per second.

5. The new cut to divert the Commamore channel and carry it under the bridge has not yet been made; but as it is absolutely necessary, I have to solicit sanction for the amount required for this excavation as well as for the sum necessary to complete the bridge as annexed—

	RS.	A.	P.
Revised estimate submitted by Colonel Moberly	20,650	0	0
<i>Deductions.</i>			
For additional towing-path	364	0	10
„ Saving of masonry in parapets	66	12	5
„ Earthwork	30	0	0
	460	13	3
Contingencies	34	2	9
	495	0	0
Amount of original estimate sanctioned in G. O., No. 1,676, of 21st May 1869	13,650	0	0
Balance to be sanctioned	6,505	0	0

6. As the bridge and new cut under reference fairly belong to the project for the extension of irrigation in the Western Delta of the Kistna, I would suggest the additional sum (Rupees 6,505) required to complete these works being charged

* Sanctioned in G. O., No. 3,215, dated 12th October 1868.

to the old estimate of Rupees 1,95,770* for the improvement of the Commamore channel.

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If Government approve of this suggestion, I trust you will arrange for Rupees 4,000 being transferred, from the Budget Item 27 to the Kolakalur Bridge, for expenditure during the current official year, and for the balance being made available in the early part of 1873-74. With reference to the last part of this suggestion, I trust Government will be able to allot funds from the Reserve, as no provision has been made in my Budget for 1873-74 to meet the proposed outlay.

7. In connection with the extra expenditure on the Kolakalur bridge, I beg to forward a letter* from Captain Vibart, R.E., and should feel obliged by your returning it at your convenience.

* No. 157, 30th May 1871.

From Captain H. M. VIBART, R.E., Executive Engineer, Western Delta, Kistna District, to the Superintending Engineer, 2nd Division, dated Camp at Guntoor, 30th May 1871, No. 157.

In reply to your memorandum giving cover to papers referring to Kolakalur bridge, I have the honour to forward the following explanations.

2. In paragraph 2 of the Chief Engineer's Note he remarks, first, on the increased rate for concrete; secondly, on the increased quantity of concrete laid down, and the increase of thickness allowed in the flooring; thirdly, on the alterations in thickness of parapets; and, fourthly, regarding the site of the new bridge. The increase of rate in concrete will be entered more fully further on, but I may state here, with reference to the Chief Engineer's statements that "the great difference is due to cost of breaking stone," that in the remarks attached to the comparative statement the difference of cost is put down "as owing to the cost of breaking stone, etc.," *vide Statement A*, thus clearly showing that there were other reasons, besides that of breaking the stone; moreover, so far from the stone from Tangellamoody having been in constant use in the delta it has been but rarely used for concrete. In this case half of the stone used was from Bezwa-da, while the other half was obtained from Tangellamoody Quarries. Now, with reference to increased quantity of concrete, the soil, which was in some parts running sand and in others slush. Some discretion in these matters must, it appears to me, be allowed to the officer in charge of such works. He is, I submit, not bound to put down precisely the quantity allowed for in the estimate should he deem, on personal examination, an extra quantity necessary. The increase of the width of parapet from 1½ feet would, as proposed by Lieutenant Smith, not diminish the roadway, as the top of the backing course would be level with it; the width of available roadway would actually be increased by 1 foot, although the parapets would not be protected from the contact of carts, as in the plan originally intended. The original plan can of course be adhered to.

3. With reference to the Chief Engineer's remark regarding site of bridge, I beg to say that the straight cut was approved by late Colonel Winscom, as being a part of the improvement of the Commamore channel. Plans and estimates for the improvement of the whole of this channel, as far as Nallamada, were submitted long ago to the Chief Engineer, but were returned by Colonel Anderson, with the remark that it would be requisite, before submitting the estimates to the Government of India, to afford such information as would enable the Government to form an opinion as to the remunerative effect of the work.

4. I have in my possession a plan signed by Colonel Winscom (which I obtained through your Manager from your office) in which the straight cut in question is distinctly laid down.

5. I wish now to make some remarks on paragraph 6 of the Chief Engineer's note, in which he states that the proper rate for concrete would be Rupees 2-15-0.

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6. I do not think that the concrete could possibly have been laid down for this amount. He has, I think, very much under-estimated the different items—

1st.—Cost of stone.—He states it should be only 13 annas, supposing it to be got from Bezwa-da, and states that this is a high allowance. In order that all the stone to be used on the work should be obtained from Bezwa-da, it would be necessary to increase the number of iron punts. These punts are limited in number, and there is frequently considerable difficulty in procuring a sufficiency of labour for loading, etc., so that it has always been considered desirable to open up other sources of supply besides those at Seetanagaram and Bezwa-da. Hence half the stone used for concrete was obtained from Tangellamoody. Stone has lately been brought from Seetanagaram to Kolakalur, for the road from Guntoor to Iyaloor, and costs Rupees 1-3-5, besides 4 annas for breaking, while the Tangellamoody stone cost only 1-7-6 (1 pie per cubic yard more); this was made up as follows:—

	RS.	A.	P.
Digging	0	7	0
Carting	0	12	0
Breaking	0	4	0
Measuring up	0	0	6
	1	7	6

7. Supposing punts to be available for the conveyance of stone, the carriage from Seetanagaram to Kolakalur will cost at least 12 annas per cubic yard, and this charge may at any time be increased by accidental delays in loading, etc., and from bad weather, not to mention the want of water in the channel towards the close of the season when the water is passed down the Commamore channel for half the week and down in the main canal channels for the remainder.

8. Major Mullins allows but two paras of chumam and four of sand; owing to the force of the springs it was found necessary to employ a much larger quantity, 2½ paras of chumam and 5 of sand. He allows only 9 annas 2 pias for labour, that is for mixing mortar, carrying stone and mortar to work spot, mixing them together on the work and ramming, which is really insufficient when the material is close to the work spot; but in this case a very considerable extra charge had to be incurred owing to the materials being placed unavoidably nearly 250 yards from the site of bridge, owing to the ground in the vicinity being always flooded when the Commamore channel is fully supplied. At the close of this report I will add a statement of cost of concrete and ashlar.

9. In paragraph 7 Major Mullins states that the rubble, including the dressing, should be executed for 5 rupees, and leads Government to suppose that the rubble was made up with small stones. The stones used, as far as I can learn, varied from 8 to 12 in width and 10 to 15" long, and the small stones seen by Major Mullins were used merely to bring the incomplete work to an uniform level when it was stopped.

10. Major Mullins states that the foundations could easily have been got in during the dry season of 1870, but as the work was sanctioned in May 1869 it was surely intended by Government that the work should be pushed on without delay.

11. He further remarks that in "soil such as is met with in the locality the baling need not be costly." The water in the foundations was very troublesome, and required a large amount of labour to keep it within reasonable bounds. I may mention here that I myself laid down the foundations of Commamore Lock in 1867, and that the springs were so numerous and powerful that we had seven archimedean screws at work night and day, besides a number of men employed with baling baskets, and we found very considerable difficulty in keeping the water down. The sum spent in baling at this lock (three miles distance from the bridge) was 4,172 Rupees, whereas only 1,500 were allowed in the estimate.

12. I beg to state that the Chief Engineer is in error in supposing that the Kolakalur bridge was under the charge of the Officer at Duggirala. The Range Officer in charge of the work resided at Chebrole, some ten miles from site of bridge, and I may add that Lieutenant Smith but seldom remained there during this period, as he had to take charge of the 3rd Range as well as his own in the month of June, just after the time that the work was commenced at Kolakalur.

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13. Great difficulty was experienced in procuring labour, partly doubtless owing to the quarries at Tangellamoody, etc., being worked at this time; but I would beg to observe that it was absolutely necessary to carry on the quarry work at Tangellamoody-Vegerla, or otherwise the works in the 1st and 3rd Ranges would have been brought to a stand-still for want of stone.

14. From the amount of the revised estimate the Chief Engineer has deducted certain items. The two first are correct, as the towing-path is not to be built and the parapets are to be built in accordance to original design.

15. But in the third item it appears as if the Chief Engineer had made an oversight. In the original estimate only 151-15-0 were allowed for earthwork; this has been found utterly insufficient, and Rupees 652-8-0 was allowed in revised estimate, leaving 500-9-0 to be sanctioned. Of this amount 100 rupees is required for filling in behind abutments, and remainder for excavation, which latter has been already spent. I suppose Major Mullins has deducted this with a view of charging 350 Rupees to the channel. I think but a very small proportion should be so charged, say 400 cubic yards (i.e., what would have been excavated had there been no bridge). This will increase the amount requiring sanction to Rupees 2,411 as shown below:—

	RS.	A.	P.
Revised estimate ..	20,650	0	0
Deduct towing-path ..	364	0	10
Increase parapet ...	66	12	5
Earthwork ...	30	0	0
New cut ...	3,807	12	0
Superintendence, at 7½ per cent. ...	320	6	9
	4,589	0	0
Reduced amount estimate ..	16,061	0	0
Already sanctioned ...	13,650	0	0
Balance requiring sanction ..	2,411	0	0

16. In conclusion, I add the data for a cubic yard of concrete.

The stone was excavated, then carted to site of work, packed and measured, it was then broken up by quite different people. It is evident that a cubic yard of rough stone would, when broken, measure considerably less than a cubic yard, as it would pack much closer. Taking then 1½ cubic yards rough stone to make 1 cubic yard of broken stone—

¾ths of a cubic yard of kunkur would equal ½ths of a cubic yard of rough stone.

The Concrete was composed of half Bezwada and half Tangellamoody stone, average cost of cubic yard would be

	RS.	A.	P.
¾ cubic yard would cost ...	0	9	6
Carting do. ...	0	7	11
Measuring ...	0	10	0
Breaking ...	0	0	6
2½ Parahs, lime ...	0	3	4
5 Do., sand ...	1	4	0
Mixing mortar ...	0	7	6
Conveying to site ...	0	7	0
Ramming, etc. ...	0	4	0
	0	11	0
Sundries ...	4	7	3
	0	5	3
	4	12	6

Actual cost Rupees 4-14-10.

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Ashlar Masonry.

The stone was obtained from three quarries:—

1st.—VAGERLA, seven miles from site, where the excavation cost 10 annas.

2nd.—BEZWADA, where stone cost 12 annas, price paid to 6th Range Officer.

3rd.—TANGELLAMOODY, four miles from site, where the excavation cost only 7 annas.

As far as the work is carried out these stones appear to have been used in the proportion of 1 to 3 to 6.

	RS.	A.	P.
A cubic yard would thus have cost ...	0	8	6
Cartage—1 cubic yard, Vagerla stone ...	1	5	0
3 Do. Bezwada ...	2	7	9
6 Do. Tangellamoody ...	4	8	0

	10 cubic yards...	8	4	9	RS.	A.	P.
Packing ...	...	...	...	...	0	0	6
Conveying to work ...	...	...	...	...	0	3	0
Dressing and re-dressing at spot ...	...	...	...	...	1	2	0
Two parahs lime ...	...	...	...	...	1	0	0
Four do, sand ...	...	...	...	...	0	6	0
Mixing sand and lime ...	...	...	...	...	0	6	0
Conveying mortar ...	...	...	...	...	0	1	0
Two Bricklayers ...	...	...	...	...	1	0	0
1½ men coolies ...	...	...	...	...	0	5	0
Two women ...	...	...	...	...	0	4	0

Superintendence, 7½ per cent ...	6	1	3
	0	6	9
	6	8	0

17. In future operations on this work it is possible that we may be enabled to get the work done cheaper as the material might perhaps be deposited nearer the site, and we might perhaps pay the bricklayer so much for each cubic yard; in fact, have it done on contract; but it would hardly do to estimate as if we were certain to be able to effect this.

18. I shall certainly do my very best to keep the charges as low as possible when the work is recommenced.

19. In conclusion I beg to state that should you raise no objection I will at an early date submit the altered estimate, and request you to be so good as to get it sanctioned at an early date.

20. I have the honour also to forward the plan* of the Toongabuddra from Duggirala downwards, showing clearly the new cuts it is proposed to make so as to straighten the channel between Duggirala and Jagarlamoodu. The new cut could be charged to the allotment of 50,000 rupees allowed for the Commamore channel.

* Plan sent in a separate cover by lock tappal.

No. 2.

No. 619c.

Note by the Chief Engineer for Irrigation.

IN G. O. of the 6th February 1871, No. 364, certain explanations were called for before disposing of the revised estimate for the Kolakalur bridge across the Commamore channel in the Kistna District.

2. In a letter, No. 29 of the 14th June 1871, from the Superintending Engineer, 2nd Division, these explanations were submitted, but the subject appears to have been overlooked until the then Officiating Superintending Engineer in a letter dated 2nd August last, asked for orders on his predecessor's communication.

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3. After a careful examination of the papers connected with this bridge, including the explanations, I regret that I am obliged still to express an unfavourable opinion both of its cost and management. In the first place the site should have been selected before any estimate was submitted for sanction; secondly, after sanction was given materials should have been collected under the best arrangements practicable; thirdly, the foundations should, after getting materials together, have been got in at the most favourable season for work of this kind. It is not necessary to attempt to put down foundations of works of this kind during the season of the freshes, and had six or eight months been allowed for making suitable arrangements, collecting materials, obtaining orders as to the site when it was thought advisable to change it, etc., instead of occasioning delay there would have been a saving of time as well as of money.

4. In my former Note I made no comment on the quantity of concrete used; the alteration made was simply noticed. Captain Vibart is quite right in supposing that an Executive Engineer has discretionary power in the case of foundations, and no objection was made to the use of it in this instance. With regard to the rate for concrete for which Rupees 3-6-0 were allowed, Rupees 4-14-10 spent, while my estimate of the proper rate was Rupees 2-15-0. I may remark that I was not aware that the materials had to be deposited 250 yards away from the bridge and afterwards carried thereto. I find on referring to my note book that I obtained the labour and cartage rates on the spot, as also the cost of stone at the quarry. From these data it was easy to deduce a rate, the quantity of material and labour required being, within very narrow limits, the same everywhere. Some of the data given by Captain Vibart for this material are, in my opinion, not admissible. The additional lime and sand used may be allowed as possibly requisite at the time when the foundations were laid; they added 5½ annas to the rate. Conveying the concrete to the bridge is put down at 4 annas, and may be admitted; but ramming, etc., 11 annas is many times too much, and as the soil is reported to have been "in some parts running sand and in others slush," the concrete under such ramming would have disappeared altogether. One-third of the charge on this account should therefore have been but little, if at all, more than one anna. I allowed 9 annas 2 pies for labour, exclusive of lead, and there is nothing in these papers to show that this should not have sufficed. Again, 5 annas 3 pies are too much to allow for sundries. Not having visited the Tangellamoody quarries, I do not know whether they possess stone available with but little labour for concrete, but at most quarries there is an abundance of small stone which can be used for concrete or for road purposes, and which would usually cost about 4 annas a cubic yard for collection and little or nothing for breaking to a proper size. The data given by Captain Vibart appear to me to require looking into in several respects. The rates for excavation or getting of stone, for cartage, etc., should all bear reference to the actual quantity required to make a cubic yard, otherwise great uncertainty must exist as to whether the right quantities are received, and in the case of distant quarries the item for cartage may be seriously and unnecessarily increased; five-sixths of a yard of rough stone, as obtained I suppose at the quarries, is put down as equal to two-thirds

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of a yard of kunkur or broken stone, if so probably this quantity would probably be but half a solid yard, on which latter the rates should be based. Probably the best arrangement would have been to break up the stone at the quarries and then to allow 14 or 15 paraahs to the cubic yard solid, according to circumstances, in fixing the rate for cartage. I was told that the cartage of stone was 4 annas a cubic yard per mile, but if the actual quantity carted for this rate

was in reality only about 15½ cubic feet,* the actual rate becomes about 7 annas a yard a mile. It has not been

stated how the rate of Rupees 3-6-0 per cubic yard of concrete entered in the original estimate was made up, and it would have been well to compare its items with those shown in Captain Vibart's letter.

5. Turning to the masonry of the bridge it may be noticed that there seems to be good reason for the Executive Engineer's remark that "in future operations on this work it is possible that we may be enabled to get the work done cheaper as the material might perhaps be deposited nearer the site, and we might perhaps pay the bricklayers so much for each cubic yard;" he adds, "but it would hardly do to estimate as if we were certain to be able to effect this." The essence of good executive supervision, so far as this affects cost of work, is in the determination, after careful examination of the actual circumstances of the work, what is the proper price to be paid on account of each component item. My experience is altogether against the assumption that Rupees 4-14-6 for concrete and Rs. 6-12-0 for coursed rubble masonry are proper proportional charges; if the latter be correct, and it is the rate entered in both the original and revised estimates, I believe that Rupees 3-6-0, the rate allowed for concrete in the first instance, should have been ample.

6. With these remarks I beg to recommend that the revised estimate for the bridge itself, amounting to Rupees 16,060, as deduced from Captain Vibart's letter, be sanctioned, and that the following items belonging to the improvement of the Commamore Channel be debited to that work:—

	RS.	A.	P.
Earthwork of new cut	3,838	12	0
Superintendence, at 7½ per cent....	321	4	0
Total ...	4,160	0	0

The second towing-path should be omitted, and the parapets should be built according to the sanctioned design.

FORT ST. GEORGE, (Signed) J. MULLINS, Lieut.-Colonel, R.E.,
2nd January 1873. Chief Engineer for Irrigation.

No. 620. *ORDER THEREON, 30th January 1873, No. 304.

CIVIL WORKS, No. 32.

UPON the recommendation of the Chief Engineer for Irrigation, the Government sanction the revised estimate, amounting to Rupees 16,060, for the Kolakalur Bridge over the Commamore Channel. The cost, Rupees 4,160, of the new cut on which the bridge, as built, is situated will be charged to the estimate for the improvement of the

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Commamore Channel, for which it is observed there is an allotment in the Budget of the current year, Item No. 27, of Rupees 20,000.

2. The history of this bridge as exhibited in these papers is very far from satisfactory. The executive management has not been at all what it should have been, and the Government trust that, in carrying the work to completion, the arrangements will be such as to ensure good work at a moderate cost.

3. Orders will be issued in the Revenue Department for the provision of half the increased cost of the bridge from Local Funds.

(True Extract.)

Captain, R.E.,

Officiating Under Secretary to Government.

To the District Engineer, Kistna.
.. Revenue Department.
.. Financial ..
.. Controller of Public Works Accounts.
.. Accountant-General.
.. Chief Engineer for Irrigation.

Data for a cubic yard of concrete

The stone was excavated, then carted to site of work - packed and measured - it was then broken up by quite different people - It is evident that a cubic yard of rough stone would when broken measure considerably less than a cubic yard - as it would pack much closer. Taking then 1 1/2 cys of rough stone to make 1 cubic yard of broken stone.

2 1/2 of cys of broken would equal -

5 of cubic yard of rough stone.

The concrete was composed of half Bezvara and half Sengellamooddy stones. Average cost of cys would be - 9-6

5/6 cys would cost - 7-11

Carting - 10-0

Measuring - 0-6

Breaking - 3-4

2 1/2 Parahis lime - 1-4-0

5 1/2 sand - 0-7-6

Mixing mortar - 0-7-0

Conveying to site - 0-4-0

Ramming &c. - 0-11-0

4-7-3

Sundries - 0-5-3

4-12-6

Actual cost Rs 4-14-10

Ashtar Masoury.

The stone was obtained from 3 quarries
1st Vagerla - 7 miles from site where the
excavation cost 10 annas.

2^d Begwara. Where stone cost 12 annas
price paid to 6 Range Officer.

3^d Langellamudy - 4 miles from site where
the excavation cost only 7 annas

as far as the work is carried out
these stones appear to have been used
in the proportion of 1 to 3 to 6.

A cyp would this have cost Rs. 0-8-6

Cartage 1 Cyp Vagerla stone - 1-5-0

3 - Begwara 2-7-9 0-13-3

6 Langellamudy 4-8-0

10 Cyp 8-4-9

Packing 0-0-6

Conveying to work 0-3-0

Dressing & redressing at spot 1-2-0

2 Parahs lime 1-0-0

4 00 sand 0-6-0

Mixing sand & lime 0-6-0

Conveying mortar 0-1-0

2 Bricklayers 1-0-0

1 1/2 mian coolies 0-5-0

2 Women 0-4-0

Superintendence 7 1/2 percent 0-6-9

Hubert

Work Construction of an Accommodation bridge across the Commanner ch at Holakabor.

Items	As Estimated for		As Expended		Less than Estimated		More than Estimated	
	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
Concrete Cyp	17-16 1/2	59 8 0	116	724 12 1	-	-	98-10 1/2	665 4 1
Rough stone in Chemam Cyp	1499	10118 4 0	1017	5101 4 6	-	-	-	-
Vertical - Ash lor work	-	-	-	869 6 3	-	-	-	-
Arch work Brick masonry	3627	6801 0	-	60 8 6	-	619 8 6	-	-
Plastering to arch face	17-36	52 1 3	-	-	17-36	52 1 3	-	-
Brick chim Cyp	51 13 27	236 15 7	-	-	51 13 27	236 15 7	-	-
Painting rough stone face	81 1/2	163 0	-	-	81 1/2	163 0	-	-
D. to Brick work	53 48 100	160 4 8	-	-	53 48 100	160 4 8	-	-
Cornice work	410	307 8 0	-	-	410	307 8 0	-	-
Coping to parapet	405	202 8 0	-	-	405	202 8 0	-	-
Metalling Cyp	74 23 27	74 13 8	-	-	74 23 27	74 13 8	-	-
Guard stones	4	12 0	-	-	4	12 0	-	-
Earthwork Cyp	2224 1/2	151 15 0	6069 1/2	674 0 3	-	-	3845 52 2 1 3	-
Centring	-	226 11 0	-	101 0 7	-	125 10 5	-	-
Palisade work	-	250 0 0	-	1615 2 3	-	-	-	1365 2 3
Lumber etc	-	954 5 10	-	1284 9 0	-	-	-	330 3 2
Total	-	13650 0 0	-	10430 11 5	-	6101 15 4	-	2882 10 9
Advances	-	-	-	109 0 3	-	-	-	109 0 3
Materials at site	-	-	-	1155 0 7	-	-	-	1155 0 7
Grand Total	-	13650 0 0	-	11694 12 3	-	6101 15 4	-	4146 11 7

Camp Eemboor
7th September/72
Amith
Officer
Hubert
Superintendent

No. 29

No 29
Superintending Engineer
Office and Dr. Biggs
16 June 1871
From
Colonel F. J. Mobley R.E.

Jan. 20th 1892

12

4. 6 Feb
Major

Some

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Confession
Statement of
Constitution
Admission
to the
College & no other
admission will
at Philadelphia

in his Charge -

2 As regards the amount of Concrete I beg to observe that Tith Smith increased the quantity in finding what a slippery quick stuff he was dealing with. I regret that

2635/72
Enclosure and
letter no 101 of
3^d October 1892
from the C.E.
Superintendent
to the Chief
Engineer for
Irrigation D.M.
—
P.W. 9/7/93.

Comparative
Statement
—

Enclosure
1 Plan
1 Data
2

No 29
Superintendent
Office and Dr. Bezada
16 June 1891
From Colonel J. J. Ingham R.E.
Superintendent Engineer D.D.
To The Chief Engineer
for Irrigation

Sir In reply to G.O. no 564. 6 Febry
I have the honor to observe that Major
Mullins appears to have made some
mistake in his Memoranda regarding the
Kolakalis bridge. I have no idea where
he received the rates he has given - nor can I
recall to memory any discussion regarding them
or the work. Supt. Campbell the Range
Officer returned to Chebrolu from Jagarlamu
and the Overseer Mr. Coghlan met us on the
spot. He had no account - we proceeded to
Bijirala where we met Mr. Harris, but
no word on the subject was said to him, or
Major Mullins would have learned that the
bridge was not, as he supposed in para 9,
in his charge.

2 As regards the amount of concrete I
beg to observe that Supt. Smith increased the
quantity in finding what a slippery quick
stuff he was dealing with. I regret that

I did not know the Tungabhadra when I sent in the Estimate as well as I do now as I am inclined to think that the water way should be increased. I received the papers as generally approved by my predecessors who had far more local knowledge than I had.

3 Both Colonels Anderson and Winscom had turned their attention to the Tungabhadra which from Bigirala to near Jagarlamidry is now flowing in its natural tortuous course. Both have had sketches prepared for alterations in form and gradient. Colonel Anderson was sanguine that some work which he commenced would tend to silt up the deep bed, and reduce the velocity of the water flowing in a wider channel. his expectations have not been, so far as I know, realized.

4 The rapidity of the stream is most inconvenient for traffic. the water rushes down to supply the cultivation below and any decrease at Bigirala stops, or seriously hinders, all traffic in the upper miles - for this reason and the actual deficiency of punts to carry materials the local Officers were obliged to seek for supplies in the neighbourhood.

5 I may mention however as a reason not remarkable

6 I had contemplated carrying the navigable canal by a higher level nearer Guntoor. the whole subject will perhaps be more conveniently discussed as a part of Commamoor project.

6 Major Drilling has also forgotten that I proposed personally to build the additional towing path as a projecting bracket above water mark. I understood that he was satisfied as to the necessity for its construction from the difficulty to boat & horse tracking on the low bank. I trust that the Government will permit me to build it as I mentioned above.

7 The Tungabhadra at the point where the road crosses and for some distance on either side has low banks which are flooded during most part of the year. All materials were therefore necessarily stored some little distance 250 yds from the actual site, if the bridge had been built in the proper bed of the Canal this extra distance would have been increased by 500. the work would have been also very considerably delayed by this presence. During 9 months of water for irrigation.

8 Labour is by no means easily procured and more specially skilled labour, and

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Major Dullins: much more difficult
= alties. The Timgahdra is the main
drain of the Western Bank. It is a sandy
bed is the natural holder of a great quantity
of water slowly percolating to sea. any foundation
work will disturb this and necessitate the
= stants halting - 7. Archimedes screws and
gangs of men with baskets were required
to keep down the water level. The Commamoor
lock 3 miles off. The cost of bulging on that
work was Rs. 4,170. 7. 1/2.

9. I informed the Engineer of the
price of the materials and labor in the
As regards Major Dullins' estimate of stone
from Surtani grain we have the actual cost
of material delivered for the road on this
very bridge Rs. 1-3-5 or 1 pie less than the
average cost from our land quarries. This
is a single instance where no accident happened.
If from any risk to the crops on the
Western Bank Channel the Surtani in the
Timgahdra had been diminished or shut
off the cost would have been much increased.
In the long time this bridge had been in
progress many reasons for delay must have
occurred which would prevent our affirming
this as a correct rate.

Sept 10

10 I beg also to protest against the
= mark regarding the use of small stones.
Mr Coghlan in my presence positively inform
= ed Major Dullins that he had, under instruction
from Sir Smith levelled the top course
with the small stones pending the sanction
of a supplemental Estimate.

11 I enclose a sketch drawn up under
instructions from Colonel Winscom showing
the cuts he proposed to make - that at the
site of the bridge being one. If this be
omitted from the Supplemental Estimate the
bridge will be of no use as the old Canal
will bear all traffic as it does now. In my
letter forwarding the revised Estimate I observed
that the cost of the cut was really debitable
to the Commamoor project - a remark which
Major Dullins appears to have overlooked.

12 I trust that the Government will be
satisfied that the excess above Estimate is
not unreasonable - we had not in 1869 when
the Estimate was prepared the experience acquired
as to cost of carriage bulging &c. &c. and future
Estimates will make one allowance.

I have the honor to be
Sir
Your most Obedt Servt

J. H. Colclough
Supt. Engrs. &c.

Sup Engineer's Office
Camp Masra
22 August 1872.

No
Re. by
From R. Smith require
Off Sup Engineer
To The Chief Engineer
for Irrigation

Sir,
I should feel obliged
by your kindly favoring
me with the orders of
Government on my predecessor's
letter, to your address, on
the subject of the revised
estimate, for the Holakabir
Bridge, in the Krishna District.
As the work is in
progress, I trust Government
will be pleased to sanction
the revised estimate at an
early date.

I have the honor to be
Sir, your most obedient
servant
R. Smith

To
11/15/72 - 11/15/72

From
11/15/72 - 11/15/72

To

To

The Chief Engineer
for Irrigation

Dated 14 June 1871

Re

Enclosed - 2
copies of explanation on the
provisional estimate regarding
the Holakabir Bridge and
forwards a plan and detail
of masonry works - also state
that revised estimate will
be submitted shortly.

R. Smith
11/15/72.

Superintending Engineer
Office 2nd Division
Bengal 23 October 1892

From P. L.

H. Esquire

ing Engineer
Division

Res P. E.
niced
m -

to acknowledge
No. 150 of
information
via bridge
& mentioned
by
joining
express
reached you

2. The expenditure
bridge up to date, has been Rs 11,694-12-3
as

3. 2 Aug 25th
No 150 - 14 Aug 92

From
The Chief Engineer

to the Chief Engineer
for bridge No. 150

Subd. 2 Aug 92
Received 3rd inst.

P. M. 9/6/93.

Respectfully
forwarded with brief
details on the subject
of the proposed bridge
from the Chief Engineer
with the District

No. 2. 2 Aug 93

No. 2-2-1873

No. 150-14

4/635/72
Enclosure in letter
No 101 of 3rd Oct
1872, from the
Offg Supg Engineer
2nd Div to the
Actg Chief Engineer
for Irrigation
D.P.M.

P.W. 96/73.

Letter from
Capt. Vibart
R.E.

No 101.
From
Superintending Engineer
Office 2nd Division
Bengal 6th Dec 1872

R. Smith Esquire
Offg Superintending Engineer
2nd Division

Major P. H. Dukes R.E.
Acting Chief Engineer
for Irrigation.

Enclosure. Sir,
Comparative
Statement
Capt. Vibart's
Letter

I have the honor to acknowledge
the receipt of your letter, No. 150 of
14th August, last, and to inform you
the level of the Kolakalia bridge
is correct. The mistake, I mentioned
to you, is in a bridge lately
constructed, over an adjoining
channel, and I have to express
my regret for having misled you
in the matter -

2. The expenditure, on the Kolakalia
bridge, up to date, has been Rs 11694-13-3

as

as will be seen by referring to the enclosed statement. The wings, ^{marked A} abutments, and piers have been built up to 11 feet, above floor level, or to within 6" of the springing line. The floors have been laid and a masonry wall, for one towing path, has been constructed. The idea of building a second path appears to have been abandoned.

3. Judging from paragraph 6, of Major Mullins' report, and from the state of the bridge as described by the Executive Engineer, in his letter of the 7th ultimo, very little, if any, work appears to have been done, since the date of the former Officer's inspection.

* Embodied in
G.O. No 364 of
6 February 1891

on 6 Aug
1891

4. The maximum velocity of the stream, on the completion of the Commamore Channel, will be 1.85 feet per second; but it will,

no doubt, be somewhat in excess of this, until the regulating works have been built, on that canal; but, I believe, arrangements could easily be made to prevent the current attaining a greater speed than $2\frac{1}{2}$ feet per second.

5. The new cut to divert the Commamore Channel and carry it under the bridge, has not yet been made, but as it is absolutely necessary, I have to solicit sanction for the amount required, for this excavation, as well as for the sum necessary to complete the bridge as annexed.

Revised estimate submitted by Colonel Moberly ————— 20650-00

<u>Deductions</u>	
For additional towing path Rs 364-00	
" Saving of masonry in parapets —————	66-12-5
For Earth work —————	30-00
	<u>460-13-3</u>
Contingencies —————	36-2-9
	<u>495-0-0</u> 495-0-0

Brought over 20,155-0-0
A mount of original estimate
sanctioned in G.O. No 1876
of 21st May 1869 ————— 13,650-0-0

Balance to be sanctioned Rs. 6,505-0-0
6. As the bridge, and new cut
under reference, fairly belong to
the project, for the extension of
Irrigation in the Western Delta of
the Kistna, I would suggest
the additional sum (Rs. 6505)
required to complete these works,
being charged to the old estimate,
of Rupees 195,770, for the improvement
of the Commamore Channel.

If Government approve of this
suggestion, I trust you will arrange
for Rupees 4000 being transferred,
from the Budget item 27, to the Kolakalur
Bridge, for expenditure
during the current official year,
and for the balance being made
available, in the early part of
1873/74. With reference to the last
part of this suggestion I trust

Government

Sanctioned in
G.O. No 3215
dated 12th
October 1868.

"Extension of the
Commamore Channel
and Construction
of the necessary
masonry works."
allotment Rs. 20,000

3rd Government will be able to allot
funds from the Reserve, as no
provision has been made, in my
Budget for 1873/74, to meet the
proposed outlay -

7. In connection with the extra
expenditure, on the Kolakalur Bridge,

No 157-30-3
May 1871 } I beg to forward a letter from
Captain Vihart R.E., and should
feel obliged by your returning it
at your convenience.

I have the honor to be
Sir
Your most obedient servant

Smith

Offg. Eng. Officer B. D.

No. 2
37

Note by the Chief Engineer for Irrigation

In G.O. of the 6 February 1871, at 1:30, certain explanations were called for before disposing of the revised estimate for ^{the} Holabatur bridge across the former moor Channel in the Nistna District.

2. In a letter, at 29 of the 14 June 1871, from the Superintending Engineer 2nd Division, these explanations were submitted, but the subject appears to have been overlooked until the then officiating Superintending Engineer, in a letter dated 2nd August last, asked for orders on his predecessor's communication.

3. After a careful examination of the papers connected with this bridge, including the explanations, I regret that I am obliged still to express an unfavourable opinion both of its cost and management. In the first place the site should have been selected

To the Chief Engineer
2-2 March 73.

12th Nov 35

From the Chief Engineer

To the Chief Engineer
for Irrigation

Revised 12-1-80

10/10/1.

Explanations

Explanations called for, regarding the Holabatur bridge.

10th Nov 73.

10th Nov 73.

Selected before any estimate was submitted for sanction, and after sanction was given materials should have been collected under the best arrangements practicable, and the foundations should, after getting materials together, have been got in at the most favourable season for work of this kind. It is not unusual to attempt to put down foundations of the fresher, and had 6 or 8 months been allowed for making suitable arrangements, collecting materials, obtaining orders as to the site when it was thought advisable to change it, &c., instead of occasioning delay there would have been a saving of time as well as of money.

In my former note I made no comment on the quantity of concrete used; the alteration made was simply noticed. Captain Vibart is quite right in supposing that an Executive Engineer

has discretionary power in the case of foundations, and no objection was made to the use of it in this instance. With regard to the rate for concrete for which Rs 2-6-0 were allowed, Rs 4-11-10 speaks, while my estimate of the proper rate was Rs 2-15-0. I may remark that I was not aware that the materials had to be deposited 250 yards away from the bridge and afterwards carried thither. I find on referring to my note book that I obtained the labour and cartage rates on the spot, as also the cost of stone at the quarry. From these data it was easy to deduce a rate, the quantity of material, and labour required being, within very narrow limits, the same everywhere. Some of the data given by Captain Vibart for this material are in my opinion not admissible. The additional time and labour needed may be allowed, as possibly requisite

requisite at the time when the founda-
tions were laid - they added 5 annas
to the rate. Conveying the concrete to the
bridge is put down at 4 annas, and
maybe admitted; but running sea
Hannas is many times too much, and
as the soil is reported to have been
"in some parts running sand and
in others slush" the concrete under such
running would have disappeared
altogether. $\frac{1}{3}$ of a man cooly per cubic
yard of concrete is sufficient for its
consolidation, and the charge on
this account should therefore have
been but little, if at all, more than
one anna. I allowed 9-2 for labour
exclusive of lead, and there is nothing
in these papers to show that this
should not have sufficed. Again
as 8-3 are too much to allow for
sundries. Not having visited the
Jangellamooddy quarries I do not
know whether they possess stone

20
41
Stone available with but little labour
for concrete, but at most quarries
there is an abundance of small stone
which can be used for concrete or
for road purposes, and which
would usually cost about 4 annas
a cubic yard for collection and
little or nothing for breaking to a
proper size. The data given by
Captain Vibart appear to me to
require looking into in several respects.
The rates for excavation or getting of
stone, for cartage sea should all
bear reference to the actual quantity
required to make a cubic yard, other-
wise great uncertainty must exist
as to whether the right quantities
are received and in the case of
distant quarries the item for cartage
may be seriously and unnecessarily
increased - $\frac{1}{6}$ of a yard of rough

rough stone, as obtained I suppose
at the quarries, is put down as equal
to $\frac{2}{3}$ of a yard of flint or broken
stone, if so probably this quantity
would probably be but $\frac{1}{2}$ a solid yard,
on which latter the rates should be
based. Probably the best arrange-
ment would have been to break
up the stone at the quarries and then
to allow 14 or 15 paraks to the cubic
yard solid, according to circumstances,
in fixing the rate for carriage. I
was told that the cartage of stone was
the same as a cubic yard per mile but
if the actual quantity carted for that
rate was in reality only about $15\frac{1}{2}$ cubic
feet the actual rate becomes about $11\frac{1}{2}$ paraks
per cubic yard a mile. It has not
been stated how the rate of Rupees 3-6-
per cubic yard of concrete entered in the
original estimate was made up, and
it would have been well to compare
its items with those shown in Captain
Vibart's letter.

Turning to the masonry of the bridge it
may be noticed that there seems to be good
reason for the Executive Engineer's remark
that "in future operations in this work
it is possible that it may be enabled
to get the work done cheaper as the mate-
rial might perhaps be deposited nearer
the site and we might perhaps pay
the bricklayers so much for each cubic
yard" etc. etc. but it would hardly
do to estimate as if we were certain
to be able to effect these. The essence of
good executive supervision, so far as this
affects cost of work, is in the determination,
after careful examination of the actual
circumstances of the work, what is the
proper price to be paid on account of
each component item. My experience
is altogether against the assumption
that Rupees 4-14-6 for concrete and
Rupees 6-12-0 for ^{coursed} rubble masonry, are
proper proportional charges: if the latter
be correct and this the rate entered
in both the original and revised es-
timates, I believe that Rupees 3-6-
the rate allowed for concrete in the

the first instance should have been ample.

C. With these remarks I beg to recommend that the revised estimate for the bridge itself amounting to \$18,000, as detailed from Captain Vibart's letter, be sanctioned, and that the following items belonging to the improvement of the communication should be allotted to that work:

Earth work Refused at 3338-12-

Superintendence at $\frac{1}{2}$ per cent 321-4-

4160--

The second towing path should be omitted and the parapets should be built according to the sanctioned design.

For St George
2^d January 1873
Whitcomb
Chief Engineer for Navigation

To

The Secretary to Government
Public Works Dept.

W. A.

Public Works Department
No 306
Proceedings of the Madras Government
Read the following

From The Chief Engineer
for Irrigation. } H.E. No 272 January 1873

Upon the recom-
mendation of the Chief
Engineer for Irrigation, the
Government sanction the re-
vised estimate, amounting to
Rupees 16000, for the Kola-
kalar bridge over the Com-
mamoor Channel. The cost
Rupees 4160, of the new cut-
on which the bridge, as
built, is situated will be
charged to the estimate
for the improvement of
the Commamoor Channel,
for which it is observed
there

W.C.

P.O. 1873 Madras
Sd/- 1873
The Chief Engineer
for Irrigation
to the Secretary, 1873

1873

Letter 2nd
Recd 1873 January
1873
Recd 1873

Sd/- 1873 - 30 "Commamoor"
Recommendation to
the sanction of the
the revised estimate
to 16000 for the
Kolakalar bridge
over the Commamoor
Channel with remarks

1873
Sd/-

there is an allotment in
 the budget of the current
 year item No 27 of Ru.
 pees 20,000

2. The history of this
 bridge as exhibited in these
 papers is very far from
 satisfactory. The executive
 management has not been
 at all what it should
 have been, and the Govern-
 ment trust that, in carry-
 ing the work to completion,
 the arrangements will be
 such as to ensure good
 work at a moderate cost.

3. Orders will be
 issued in the Public
 Department for the provi-
 sion of half the increased
 cost

cost of the bridge from
 local funds.
 W. G. M. 6/1/73

70/8

To the Honble Member
 Rev. Secy
 Public Dept
 Controller
 Secy to Govt
 Secy to Govt

3/29/90
Vol. of 1873 India

PUBLIC WORKS.

The District Engineer
Madras

Encl. 7

U. O. 30" Scale, No. 304.

No. 1199620

Kalakalar Bridge
over the narrow
channel. Revised
estimate for the
Kalakalar Bridge
proposed with
locks.