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Government of Madras.

Public Works **DEPARTMENT.**

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Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
18th June 1867.*

No. 404. Read the following letter from the Consulting Engineer for Irrigation and Canal Company, to the Secretary to Government, Department Public Works, dated Madras, 30th May 1867, No. 14 :—

- * 1 Letter from the Agent, dated 8th August 1866, No. 162.
- 1 Do. to Agent, dated 11th August 1866, No. 108.
- 1 Do. from the Agent, dated 11th September 1866, No. 223.
- 1 Do. to the Agent, dated 20th September 1866, No. 143.
- 1 Do. from the Agent, dated 22nd May 1867, No. 83.
- 1 Do. do. dated 8th Aug. 1866, No. 163.
- 1 Do. do. dated 15th Aug. 1866, No. 176.
- 1 Statement showing details of expenditure for masonry works in the 4th Section.
- 1 Comparative Statement.
- 1 Abstract Supplemental Estimate.
- 14 Estimates.
- 14 Plans.
- 2 Sections.

					RS.
† Works	...	...	...	...	45,900
Estimated Sundries	...	...	...	...	3,581
					49,481

1. I have the honour to submit, for the consideration of Government, the correspondence, estimates, statements, and plans, as per margin,* having reference to the masonry works of the 4th Section, or Nagatore Division of the Madras Irrigation and Canal Company's Main Canal.

2. The amount originally sanctioned for the masonry works of this section was Rupees 49,481.† Subsequent sanctions increased this sum to Rupees 1,10,247, and the total of the present revised estimate is Rupees 1,82,870; the supplemental sanction required is therefore Rupees 72,623. The difference between this and the amount shown in the Chief Engineer's estimate is due to a

slight mistake in the latter, as to the sum already sanctioned for contingencies.

3. The revised estimate was first received on the 10th August last, and its examination was at once commenced; as, however, it was found that the comparative Statement did not exhibit the quantities of work done, and as, without this information, not only was the Statement useless, but it was impracticable to ascertain

† On the 11th August.

to what causes the excessive cost of the work already done was due, I at once wrote to the Agent pointing out the omission, and why it was necessary that it should be supplied. On the 13th September I received particulars of expenditure on four of the masonry works of the section and, as the wording of the Chief Engineer's letter seemed to show that he thought they were the only works, the details of which had been omitted, the

Paragraphs 1 and 2 Chief Engineer's No. 414, 4th September, and reply to Agent No. 143, 20th idem.

mistake was noticed, and a list of the works, of which the quantity of work done was not stated, was given.

4. With the Agent's letter No. 83, of the 22nd instant, was received a Statement showing, with the remarks contained in the Chief Engineer's letter, all the information available regarding the actual amount of past work. The Statement is called by the Chief Engineer a comparative Statement, but it does not give the information which the Statements so denominated are intended to convey, because it shows only the amounts and, in some cases, quantities, of the items sanctioned, and the amount spent without, except in a few instances, details of the quantities of work done, and the latter are essential to a comparison of actual with anticipated results. The preparation of the comparative Statement, in the form which is

required to accompany all applications for supplemental sanction, is an easy matter if a proper record of work is regularly kept, but, in the absence of such record, it is of course most difficult to ascertain what has been done, or to apportion the total expenditure on any particular work to the different descriptions of work which may have been executed. In the case of masonry works, the requisite system of record is extremely simple, and it might have been expected that any Engineer would have considered it necessary, as a preliminary to each successive payment on account of work done, to cause such work to be measured up and recorded. It would appear, however, that whatever arrangements were made for ascertaining, at the time, what progress had been made on the masonry works in this section, either no records were kept, or else they were made in such a way as to be incapable of future reference.

5. The comparative Statement as originally received, and which from the absence of quantities of work done with the cost of each, is useless, except for the purpose of comparing the estimated former and present cost of the works, shows that the masonry works which have most largely exceeded the sum which was supposed to be sufficient are—

Estimates.

	Former.	Present.
First Culvert, 3 feet, No. 2, 45th mile ...	Rupees 1,400	2,890

The quantity of masonry allowed was cubic yards 213, the certificates of work appear to show that 295, cubic yards were paid for, and the measurements give 264, cubic yards. Similarly, the excavation entered in the estimate was 1,396 cubic yards, that paid for cubic yards 6,236, that calculated as performed cubic yards 2,740. In explanation of the very great difference, it is mentioned that it is probable that some extra earth-work has been included in the larger quantity.

Estimates.

	Former.	Present.
Second Culvert, 8 feet, No. 1, 46th mile ...	Rupees 4,708	8,148

Much of the increased cost is due to the absence of proper provision originally for the excavation of the inlet and outlet channels. The total excavation allowed for was cubic yards 548, and that executed, as ascertained partly by calculation and partly by measurement, was cubic yards 8,475. On the other hand, cubic yards 13,093 would seem to have been paid for. The bill of cost, also given in the Statement, shows 792 cubic yards of masonry paid for, while the estimate provides 551 cubic yards, and no explanation is given of the cause of a difference which must have been occasioned either by over-measurement, or by a wide deviation from the original design.

Estimates.

	Former.	Present.
Third Culvert, 8 feet, No. 3, 49th mile ...	Rupees 4,573	9,628

In this case the excavation is represented as having cost Rupees 5,595 against Rupees 1,370 allowed; while, on the other hand, the masonry estimated at Rs. 3,067 will amount to only Rupees 2,192, when the work remaining to complete shall have been finished. There can be little doubt, I think, that the records do not

show accurately the actual expenditure on either description of work, for it is most unlikely that the masonry could have been executed at two-thirds the rate allowed in the estimate.

§ Rupees 3-8-0 a cubic yard.

Estimates.

	Former.	Present.
Fourth Culvert, 14 feet, 53rd mile ...	Rupees 4,003	9,709

The information furnished regarding this work is very scanty. Some of the excavation is said to have cost as much as Rupees 1-10-0 a cubic yard. The estimate allowed 4,047 cubic yards, of which 2,341 were done, according to the measurements, in and up to April 1865, at a cost of Rupees 832-15-0. Since then cubic yards 903 or, as put down in another place, 1,003 cubic yards, were executed by contractors for Rupees 332-12-0; and I do not see where the expenditure, Rupees 1,327-14-10, stated to have been incurred for 805 cubic yards done by coolies has been entered, though from this is deduced the information that an expenditure of Rupees 773-13-6 on coolies represents cubic yards 476 of excavation. Neither the Statement nor the Chief Engineer's last letter refer to the masonry of this culvert, but it would appear that instead of cubic yards 991, entered in the estimate of 1864, that paid for with that remaining to be done amount to cubic yards 1,298. Additional masonry was certainly needed, as was pointed out in paragraph 5 of my letter of the 24th

Proceedings Madras Government, 14th December 1864, No. 3,576.

November 1864, No. 155, and the whole of the masonry work done before the size

of the culvert was increased had to be taken down, and this would add considerably to the total quantity, so that probably the total is not much, if at all, in excess of what was necessary.

Estimates.

	Former.	Present.
Fifth Culvert, 8 feet, No. 5, 59th mile ...	Rupees 4,671	7,590

The only work done here at the time the revised estimate was prepared was excavation, the quantity being cubic yards 3,977, at a cost of 2,793 Rupees, the allowance in the estimate being Rupees 443 for cubic yards 1,814, of which 1,267 were expected to cost 3 Annas, and the rest 6 Annas a cubic yard.

Estimates.

	Former.	Present.
Sixth Bridge, No. 1, 45th mile ...	Rupees 10,397	16,029

This work is noticed in both the Chief Engineer's last letter, and in the Statement which accompanied it. The increased cost is mainly due to the approaches. The estimate allowed excavation, which went, or should have gone

		Rs.	A.	P.
Into the approaches,	Cubic yards	2,483	310	7 0
A distinct item ...		13,645	1,421	5 8
Filling over arch and abutments		469	58	10 0
Do. between wings and approaches		14,435	1,202	14 8
		31,032	2,993	5 4

Average rate per cubic yard 1 Anna 7 Piec nearly.

The sections taken of the approaches and other records make the total of the

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earth-work executed cubic yards 29,571; the quantity paid for appears to have been cubic yards 35,541, and the cost Rupees 7,026-12-8, which makes the average rate 3 Annas 2 Pice nearly. Now, the pits from which the earth or a part of it was taken, were cut within the base of the slopes to the embankments, and so the earth was first unnecessarily taken out and then had to be filled in again. The rate at which this work was done was, on the average, higher than was necessary, considering that considerably more than half the total quantity, that in the lower part of the approaches, could have been done at very nearly the estimate rates. However, admitting the actual rate the proper value of the work would be

Cubic yards ... 29,571.5
Deduct into slopes of pits ... 1,705.5

27,866. Cubic yards at 3½ Annas.

5,515 Rupees instead of Rupees 7,027.

In his last letter the Chief Engineer mentions that the approaches have been made much flatter than was intended, and that consequently the amount of work has, in one approach, been trebled, and in the other doubled. It will be seen, however, from the above remarks, that the estimate provided considerably more earth-work than the measurements show to have been executed, and it would seem therefore that the Chief Engineer is mistaken.

7th. The excess on calingulahs is considerable.

		Estimates.	
		Former.	Present.
Calingulah No. 1, 47th mile	Rupees	11,495	16,176
Do. „ 2, 52nd „	„	9,401	13,035
Do. „ 3, 56th „	„	11,041	13,870
Do. „ 4, 59th „	„	11,641	18,580

Of the increase on No. 1 Calingulah, Rupees 794 are due to additions required to make the aprons safe, and Rupees 1,250 to sluice shutters with lifting gear. The explanations regarding the rest are incomplete and not satisfactory. The estimate allowed 1,583 cubic yards* of rubble masonry; the measurements appear to show 1,940 cubic yards nearly, and 2,706 cubic yards have been paid for. Now, a calingulah is such a very simple work to measure, that it is difficult to understand why the payment for a single yard in excess of the work done should have occurred, and it is still more difficult to suppose that ordinary care would not have prevented the payment for a very large quantity in excess of what the estimate allowed, or of that which could possibly have found a place in the work.

Vide Proceedings Madras Government, 14th December 1861, No. 3,576, and 16th February 1865, No. 461.

* Including covering stones.

Calingulah No. 2 is situated within a stone's throw of the residence of the Engineer of the Division, yet 4,489 cubic yards of excavation appear to have been paid for, the quantity of work of this kind done being calculated at 1,613 cubic yards. The Officer who examined the work, and the Chief Engineer, are agreed that the records are unreliable, and there can be no doubt that fraud has been perpetrated, for it is impossible to believe that with an estimate allowing 1,583 cubic yards of masonry, and measurements giving the work done at 1,690 cubic yards

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approximately, the insertion of 3,343 cubic yards in the certificates of work done could have been other than a wilful disregard of fact.

In Calingulah No. 3 the excess, after allowing for extra works, such as sluice shutters with gear, &c., is small, and the masonry paid for is 50 cubic yards less than that executed, the excavation, on the other hand, being half as much again as the measurements give.

Calingulah No. 4 promises to be so expensive a work that, as but a small part of the body had been built, it would have been advisable to re-cast the design and provide all the discharging power needed in a more compact form. As on a former* occasion it was pointed out these designs would have done very well had the works been required in a country altogether different to that in which these weirs had to be built, but, under the actual circumstances of the sites, they have occasioned a great waste of money.

Estimates.

Former. Present.

8th, Bridge No. 2, Jupad, 60th mile ... Rupees 14,512 26,463.
Up to the time of the preparation of the estimate, Rupees 10,217-11-8 had been expended, and the value of work and materials was—

		RS.	A.	P.
Excavation, 200 cubic yards at 2 Annas ..		25	0	0
Masonry, 450 do. at 5 Rupees*		2,250	0	0
Rammed and filling, 95 do. at 4 Annas...		23	12	0
Materials		1,000	0	0
Total...		3,298	12	0

Difference 6,919 Rupees.

The Statement and the Chief Engineer's letter show that many effective measures were taken for wasting money, and the results are what might have been anticipated from those means. This bridge has merely taken its share of the incompetence, which unfortunately, for a considerable time, characterised the supervision of the section, and the reviews of the earth-work and revetment revised estimates, abundantly show how gross has been the neglect and carelessness with which the duties of the Executive Engineer, at that time, were carried on, and how entirely his proceedings were uncontrolled. In the future this bridge is estimated to cost 16,246 Rupees, in which there is an increase of Rupees 5,121 due to the approaches, and of Rupees 1,683 for sundry extra works, including arrangements adopted to make a temporary bridge in anticipation of the expected supply of water from Soonkasala, although above this point there were great gaps in the embankments, of the filling up of which there was no prospect. The Chief Engineer has made some observations on this bridge in the remarks dated 25th July 1866, attached to the Agent's letter No. 162. It is not clear why the site of the bridge was changed, for it is certain that no appreciable advantage to the traffic will result. In the original longitudinal section, the site is marked at a point where the canal was in two feet cutting, whereas the plan showing the portion of the bridge remaining to be completed makes the cutting one

Proceedings Madras Government, No. 3,676, dated 4th December 1865.

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foot at the right abutment, and the ground four feet below bed level at the opposite side. The road or track, in connection with which the bridge will be, is not a made-road, but simply a cartway through the scrub jungle, and it might easily have been diverted to the original site, which was a few chains higher up the canal.

6. With regard to the remarks contained in the Chief Engineer's last letter on the subject of the difference between the quantity of excavation paid for at some of the culverts, and that ascertained to have been executed, all that can be said is that so far as the supposition, that much of the difference is due to the repeated silting up of the excavation, tends to reconcile the discrepancies, it leads also to the conclusion that there was great want of care in the management of the works. If banks be thrown up across the drainage of a country, and if the only passages left for the water be at the sites of excavations for culverts, and then, if the construction of those culverts be delayed, of course the excavation will become filled in on the occurrence of the first fall of rain. If also, when this has once happened, the Engineer contents himself with clearing out the excavations and leaving them to be again refilled, he evidently needs to be dealt with in some way which would serve to impress upon his mind the personal disadvantage of neglecting his clear duty of providing for the efficient conduct of all the works under his charge. The Chief Engineer instances the silting up of the culvert in the 60th mile, to show how much silt does accumulate, but it should be added that there, too, it might have been readily foreseen that such accumulation was inevitable. The culvert was not commenced and completed, and the banks closed up to or over it, in one season, which might easily have been managed; but the side walls were built and the drainage left to go as, and where, it pleased, and the conditions of the channel between the walls and in the outlet were dissimilar to those of the natural drainages, and as the fall in the former was necessarily less than that in the latter, silting was the natural consequence of the arrangements made. There is, too, another point of some consequence. An Executive Engineer is bound to record all the work for which he expends money entrusted to his care, and he is especially bound to be careful and particular in recording extra work, and this too of a description as in the case of this silt, which could not be traced after it had been cleared out. If, as the Chief Engineer says, "it is impossible now to say positively what were the respective rates for original excavation and for removing silt, since the two may have been let together at times for an average rate," it shows that the Engineer did not take the trouble to ascertain and record what work had to be done, and to fix approximate rates according to the nature of the work.

7. The additional works included in the present estimate are—

			Rs.	A.	P.
Retaining wall,	44th mile	...	92	8	0
Temporary bridge,	47th "	...	650	13	2
No. 1 A. bridge,	48th "	...	6,948	1	8
Three feet culvert, No. 4,	50th "	...	2,289	4	6
Do. No. 5,	52nd "	...	1,162	13	4
No. 1 open wall culvert,	51st "	...	695	12	9
No. 2 Do. do.,	54th "	...	835	4	4
Total...			12,674	9	9

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As a set off against the above, one ferry boat has	Rs.	A.	P.
been superseded	600	0	0
There is a balance of the sanction for the abandoned eight feet culvert in the 48th mile	2,355	7	5
Total...	2,955	7	5

8. The retaining wall in the 44th mile is a trifling work, to prevent the rear slope of the left bank of the canal interfering with a well. This wall is finished. The temporary bridge in the 47th mile was built last year, it has not as yet been required, and probably it will not be needed at all, unless the construction of the permanent bridge be delayed. However, but for the failure of the banks in the second section, it would have been brought into use last year.

The No. 1 A bridge is intended to provide a crossing in lieu of the abandoned culvert in the 48th mile. It is referred to in my letter as per margin,* and its construction has not been commenced. The two 3-foot culverts in the 50th and 52nd miles were necessary works, and they have been completed.

The two open wall culverts in the 51st and 54th miles were commenced without sanction, were damaged by the first rains which occurred, and were then wisely abandoned after some 1,500 Rupees had been expended upon them. Probably had they been completed, and the embankment filled in, they would have occasioned heavy loss, and it is fortunate that works so unsuited to the purpose for which they were designed were carried away before more money had been wasted.

9. The most unsatisfactory circumstance connected with the large expenditure, past and prospective, on the masonry works of this section is that not only has money been undoubtedly wasted, but the work done is in many instances inferior. With the one exception, the Jupad bridge in the 60th mile, increased cost has not been caused by superior work, and the only creditable piece of masonry, which had, up to my last visit, made much progress was the 14-foot culvert at Puggydial in the 53rd mile. It is not practicable to ascertain now what amount of money has been unnecessarily expended, first, because it is not accurately known how much work has been done, or what the work has cost, and secondly, because the section has been so greatly mismanaged, that it would be very difficult to fix proper rates for the valuation of the work. Even were it probable that farther investigations would throw any more light upon those works, of which the present are most in excess of the former estimates, it would not be worth while to occupy the Chief Engineer's time, and that of the Engineers recently appointed to the section, in examinations of works and certificates regarding which enough has been ascertained to show that the former were not properly looked after, and that the latter were prepared in such a manner as to make them extremely valueless as records of past transactions. I beg, therefore, to recommend that the additional sanction, Rupees 72,623, asked for be given, to enable the Chief Engineer to get on with the works.

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From the Agent and Manager, Irrigation and Canal Company, to the Consulting Engineer for Irrigation and Canal Company, dated Madras, 8th August 1866, No. 162.

1. I have the honour to transmit, for the sanction of Government, the undermentioned plans and supplemental estimates for masonry works in the 4th Section, with copy of the Provisional Chief Engineer's letter No. 300, dated 25th July 1866, and its accompaniment:—

Plans.

- 1 Plan of Traffic Passage, 14 feet culvert at 52 miles 32 chains.
- 1 Do. do. 6 " " at 59 " 33 "
- 1 Do. do. 3 " " at 49 " 42 "
- 1 Do. do. 8 " " at 58 " 38 "
- 1 Do. do. 8 " " No. 3 at 48 miles 50 chains.
- 1 Do. Culvert under approach to bridge No. 2 at Jupad.
- 1 Do. Bridge No. 1A.

1 Tracing from the original drawing showing portion of Bridge No. 2 at Jupad remaining to be built, to accompany Supplemental Estimate.

1 Plan of scouring sluices and approaches for Calingulah No. 3.

1 Do. Calingulah No. 4, 59th mile.

1 Do. proposed Ferry at 55th mile, 40 chains.

Estimates.

1 Supplemental Estimate, 8 feet culvert, formerly No. 5 now No. 3.

1 Do. do. 8 " " " 3.

1 Do. do. 14 " " at Puggydial.

1 Do. do. for completion of Bridge No. 2 at Jupad.

1 Estimate of proposed Bridge No. 1A in 48th mile.

1 Supplemental Estimate for completion of Calingulah and Apron No. 1.

1 Do. do. do. do. " 2.

1 Do. do. do. do. " 3.

1 Do. do. do. do. " 4.

1 Statement of actual expenditure on 3 feet culvert " 4.

1 Do. do. do. 3 " " " 5.

1 Revised Estimate for 6 feet culvert at 59th mile 33 chains.

1 Abstract Supplemental Estimate in duplicate.

1 Comparative Statement do.

From the Provisional Chief Engineer, to the Agent and Manager for Irrigation and Canal Company, Madras, dated Kurnool, 25th July 1866, No. 300.

1. I have the honour to forward eleven Plans and twelve Supplemental Estimates, with Abstract and Comparative Statement of the 4th Section, Main Canal, together with a Report to accompany the same.

2. The chief point requiring remark is that there are only two copies of the detailed estimates: one for the Board, the other for the Consulting Engineer; for as the Government allows the Consulting Engineer to sanction the alteration of details without reference, it seems unnecessary that Government should pass any other than the abstract of all the estimates* and the comparative Statement,* of which documents as usual, four copies will be forwarded.

* That is, total amounts.

3 Copies of Comparative Statements will follow.

2 Do of Abstract.

3. With regard to the bills of cost "as per Form II, II" for some of the works, it has been thought better not to delay the estimates pending the collection and arrangement of information as to these amounts. Should the Consulting Engineer require it, however, this information will be furnished hereafter.

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13th June 1867.*

Remarks on the revised estimate for completing the masonry of the Main Canal, 4th Section.

* 45th Mile.

The works requiring notice are the following Bridges:—No. 1* is finished. The approaches have been made much easier than was specified in the drawings; and this may partly account for the pits having been so near the toe as to require partial re-filling. The result is a more convenient bridge than was before sanctioned. The contractor was allowed to make this mistake during a few months while Messrs. Hawksworth, Monckton, and J. Johnston were in charge of the Range.

* 48th Mile.

No. 1* A.—Is proposed at a site approved by Major Flint near Moschrurri.

* 60th Mile.

No. 2.—This is to be built on the original design, except that owing to alteration of

site; the approaches are increased from 28,549 cubic yards to 42,226 cubic yards, and the rate also. The rates for the rammed filling were also too low. These rates are increased from 1 Anna 4 Pies and 1 Anna 8 Pies to 3 Annas (30 feet maximum height) and from 2 Annas to 4 Annas respectively.

A culvert is inserted for passing the land drainage under the approach, as is necessary on this site.

These alterations cause an increase of some Rupees 5,270. The remaining Rupees 7,730 of the total increase is for past work.

At the end of last January the expenditure is shown at Rupees 7,365-1-9. The excavation was then partly out, and the stone for cut-waters advanced. The kind of cut-water was made both sharper than sanctioned, and also of cut stone not merely dressed on face and joints.

1. Rupees 2,426 6 5 had been spent on stone-cutters.

2. " 1,232 12 2 on coolies.

3. " 1,180 13 3 on stones.

4. " 204 0 0 on chunam (useless).

5. " 739 13 0 on sand.

6. " 1,562 1 10 on carting stone.

And the result was work which did not in proportion to its cost tell towards meeting the estimate. The first and second items (stone-cutters and their coolies, and also wuddahs) had run up far beyond what was required by the estimated class of work. Item 3 is moderate; 4 and 5 were damaged by exposure; and items 5 and 6 were necessarily excessive for reasons I have before explained, viz., that whether hired or purchased, bandies must be kept at work, or at all events charged in the wet weather. Of course, I do not include hired farmers' bandies, but hired wuddahs' bandies, whose drivers live by their trade.

Whether it is well to sell the Company's bandies in June, and to lose the wuddahs' carts by refusing all employment in wet weather, is a matter of calculation or opinion at the time. I do not know a better place to cart stone to in the wet weather in this Range than to the Jupad bridge; but the road even to this is a very soft track in wet weather.

Since then, about 200 cubic yards of excavation, 95 of wet and rammed filling, 450 of masonry have been done. The sand and stone previously prepared have been used, but not the chunam-like granite at Sookkasalah; the cut-stone in the cut-waters was estimated at Rupees 10 a cubic yard, and like that granite, the work, by mismanagement of the Overseer, and during inattention, even it may be of the Divisional Engineer, will run up to 25 Rupees to 30 Rupees a cubic yard before it is finished; the work being chisel-work, and therefore absurdly expensive. Every effort has been made in many cases, and I believe in this (for the Overseer knew his work and had been a mason in England) to get natives to use a chisel with reasonable effect, but without success. The fact is not better than is desirable for the cut-waters of a permanent rough bridge; but its excessive and absurd cost, as executed by the natives, is prohibitory.

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Culverts.

44th Mile.

Three feet culvert, No. 1, is finished, except coping.

45th do.

Do. do. „ 2 „ „

47th do.

Do. do. „ 3 „ sloping the outlet.

50th do.

Do. do. „ 4 „ some silt since removed.

This last is a type of the others; it was estimated like them at Rupees 1,490, no outlet nor inlet being included. It was commenced last (April) year to be built, and the masonry cost Rupees 669-13-4, instead of Rupees 1,118-12-2, as allowed in the estimate.

The excavation, however, including outlet and inlet, has cost Rupees 1,359-14-0. Puddling and coating with concrete has been efficiently done, and the whole is Rupees 2,289-4-6.

52nd Mile.

Three feet culvert No. 5.—Excavation and puddle has cost Rupees 545 only, the outlet being easy. The masonry cost Rupees 617-13-4. Total 1162-13-4.

Eight feet Culvert No. 1.—The excavation for the outlet of this culvert has been very heavy in rocky ground. Apart from that, the excess would have been a mere trifle, balanced by savings elsewhere.

47th Mile.

Eight feet Culvert No.—2. Rupees 2,217-1-6 having been spent in partly excavating the outlet, this culvert was abandoned.

49th Mile.

Eight feet Culvert No. 3.—For this, the sanctioned estimate for the items it embraces is more than sufficient as usual; but Rupees 5,595-1-5 had been spent, and some Rupees 1,100 still required spending in the excavation of the outlet. With a fall in the country, generally, in the hollow of the water-courses under six inches in the 100 feet, and often less than half that, an outlet cut in rock sufficient to give free egress to the full discharge of the culvert, without ponding back the water and threatening the destruction of the culvert, is a very expensive business. The sanctioned expenditure for this culvert is apparently Rupees 4,572-8-11, and Rupees 5,054-15-7 (contingencies) only is required more, notwithstanding the concrete coating and puddling to barrel and parapet to ingress road and egress road, &c.

53rd Mile.

Eight feet Culvert No. 4 is converted into a 14 feet culvert, since it crosses an important road; Rupees 4,002-14-8 has been sanctioned for a culvert, only Rupees 3,144-2-9 had been expended to the end of September last. The 14 feet culvert will cost Rupees 10,000 and over. For this culvert the original rate for rubble work (Rupees 2-8-0 a cubic yard) was too small. Stone is brought two miles; and lime and sand, five miles.

56th Mile.

Eight feet Culvert No. 5.—Rupees 2,792 had been spent, one may almost say, on inlet and outlet, and foundations alone Rupees 4,671-1-3 is sanctioned, but Rupees 2,919-6-8 will be required in addition.

60th Mile.

Six feet Culverts.—This will only require an addition of Rupees 175-6-5 to the sanction, although an outlet, paved slope below barrel inside canal, &c., are added; and the excavation has been taken out so broad that Rupees 90 will be spent in masonry packing between the haunches and sides of excavation.

47th Mile.

Calingulah No. 1.—Has been executed on the original design and an apron added. It still wants 800 Rupees worth of work. The estimate for calingulahs without sluices sanctioned, gives an average of Rupees 26-12-0 for every 100 yards opening, to which 30-8-0 Rupees (nearly) was added for aprons. The present one will cost Rupees 74-8-0 per 100 yards, including sluices, and sluice apron with wing and retraining walls, but not raising gear.

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52nd Mile.

Calingulah No. 2 is now estimated, when complete, to cost Rupees 58-8-0 per 100 yards; in this calingulah an apron at 1 in 4 of stone on edge, in chunam 1 foot, which at 4 Rupees a cubic yard will be tried, instead of the sanctioned one at 1 in 6 of dry stone, 1 foot 6 inches thick, for which Rupees 5 a cubic yard has been sanctioned. The above rate includes sluices, &c., but not lifting gear.

56th Mile.

Calingulah No. 3 also contains a sluice of five openings. It is proposed to raise the towing-path over these sluices, so as to clear the raising gear from danger of a tow-rope. It is estimated to cost Rupees 63-6-0 per 100 yards of opening, the rate of rubble work being Rupees 4 now.

Calingulah No. 4 is generally similar to the above, Nos. 1 and 2; but the rate for rubble is Rupees 4. It is estimated to cost Rupees 87 nearly per 100 yards opening. The original rates were Rupees 2-8-0 throughout.

There are a few other items, viz. :—

44th Mile.

Retaining Wall.—To keep the bank clear of a well into which the toe would otherwise run, Rupees 92-8-0.

Open wall Culverts.—Two of these were tried in the tank bunds on each side, Pagadiyal 51st and 54th miles. They were abandoned.

Ferry.—One at 53½ mile is proposed. The canal then has only one bank. A light foot bridge would, I think, be more satisfactory. The original estimate for masonry in Nagatoor Division was Rupees 51,402. Subsequent additions raised it to Rupees 1,09,460; Present estimate raises the total cost to Rupees 1,82,870.

* H. H.

Some further details of the sums expended have been already forwarded in the Divisional Progress Certificate* of September and October last.

KURNOOL,
25th July 1866.

(Signed) W. J. LOWE,
Pro Provisional Chief Engineer.

(True Copy.)

(Signed) F. H. HENSLOWE,
Agent and Manager.

From the Consulting Engineer, Irrigation and Canal Company, to the Agent and Manager, for Irrigation and Canal Company, dated Madras, 11th August 1866, No. 108.

1. The revised masonry estimates of the 4th Section reached me yesterday, and I have just commenced their examination. I find, however,

that the Comparative Statement is a blank as regards the quantities of work already performed, and the reference in the heading of the column to the Progress Certificate is of no use, as that document is not furnished to this Office, and the Progress Reports would not in any case exhibit the details required in a Comparative Statement.

2. When, as in the case of the Vagus alluded to in the last paragraph of the Chief Engineer's No. 307 of the 28th ultimo, the quantities of work done have not been, and cannot be, accurately ascertained, the quantities paid for and entered in the detailed accounts should be noted, with a remark to that effect in the remark column.

3. I will add, in conclusion, that the Comparative Statement is almost a useless document without the quantities of work done. The object of the statement is to show how far the expenditure is represented by a fair equivalent in work done, and also the rates originally allowed, those at which the work done has been performed, and those deemed necessary for the completion of the remainder. It therefore only occasions delay when this document is transmitted without the insertion of the details which are to render it valuable.

*Proceedings of the Madras Government, Public Works Department,
18th June 1867.*

P. S.—I find a difference in the amount of contingencies shown as already sanctioned by the Chief Engineer and that on record in this Office; and I shall be much obliged if the Chief Engineer will give me the particulars of the items composing the Rupees 9,237-13-4, which he has entered.

From the Provisional Chief Engineer, to the Agent and Manager, Irrigation and Canal Company, Madras, dated Kurnool, 4th September 1866, No. 414.

4th Section—Masonry.

1. I have the honour to forward, in duplicate, bills of cost for the four works in the 4th Section, which are entered only in block sums in the revised masonry estimate.

2. They are two "wall culverts," one retaining wall near a well close to bridge No. 1, and one temporary bridge in the 47th mile.

3. Regarding the two former, their object was to allow of a tank bank being breached (after the water in the canal had considerably lowered) for the purpose of repairing revetment, &c., it being considered that the protection afforded by these walls (perpendicular to the line of bank) would confine the breach when made within the required narrow dimensions. Considerable freshes in the streams in which they were respectively situated, however, partially destroyed both of these "culverts," before they were completed or covered in. This fast led to their total abandonment as a protective work; hence these bills of cost are merely for the sums which were actually spent upon these now abandoned works.

4. As for the "retaining wall," I find nearly three times as much masonry in it, as is shown by the bill of cost. I can only account for this by supposing that the balance of rubble masonry was charged to bridge No. 1, which is within a stone's throw of it. A drawing accompanies the bill.

5. A drawing, in duplicate, is also furnished for the temporary bridge. I regret to have to point out that, as in forwarding the bill for this work, Mr. Wilks has included two items (Rupees 117-15-0 + Rupees 14-11-0 = 126-10-0) of expenditure made on account of this work in the Nagatoor Workshops, which was unfortunately passed over when preparing the revised estimates. This quantity, Rupees 126-10-0, will have to be added to the bill of cost in the estimates forwarded with my No. 300 of 25th July 1866; but I do not recommend that the total amount applied for be increased, but that a corresponding decrease be made in the amount of "Sandries."

With 4 Drawings and

4 Estimates

(Signed) W. J. L.

(Signed) J. H. LATHAM,

Provisional Chief Engineer.

No. 223.

Copy forwarded to the Consulting Engineer with

1 Plan of retaining wall in 44th mile (in duplicate.)

1 Do. temporary bridge in 47th mile do.

1 Estimate for wall culvert No. 1. do.

1 Do. do. do. 2. do.

1 Do. retaining wall in 44th mile do.

1 Do. temporary bridge in 47th mile do.

MADRAS,

11th September 1866.

(Signed) F. H. HENSLOWE,

Agent and Manager.

From the Consulting Engineer, Irrigation and Canal Company, to the Agent and Manager, for Irrigation and Canal Company, dated 20th September 1866, No. 143.

1. I have the honour to point out that paragraphs 1 and 2 of the Chief Engineer's letter No. 414, of the 4th instant, a copy of which was transmitted with your No. 223 of the 11th idem,

1 Comparative Statement.

appears to have been written under a mistake; and I beg therefore to return the Comparative State-

*Proceedings of the Madras Government, Public Works Department,
18th June 1867.*

ment, which ought to have accompanied my letter No. 108 of the 11th ultimo, from which it will be seen that the quantities of work done are not entered for

Culvert No. 1, 44th mile.

Do. .. 2, 45th do.

Do. .. 1, 46th do.

Do. .. 3, 47th do.

Do. .. 2, 47th do.

Do. .. 3, 49th do.

Do. .. 4, 53rd do.

Do. .. 5, 59th do.

Do. .. 1, 60th do.

Bridge .. 1, 45th do.

Do. .. 2, 60th do.

Calingulah .. 1, 47th do.

Do. .. 2, 52nd do.

Do. .. 3, 56th do.

Do. .. 4, 59th do.

2. I have not overlooked the references made to some of the above works in the Chief Engineer's remarks, dated 25th July last, which accompanied the revised estimate; but those remarks do not show the quantities of work of the several kinds done for the money expended, and the portion of expenditure belonging to each kind of work.

From the Chief Engineer, Irrigation and Canal Company, to the Agent and Manager for Irrigation and Canal Company, Madras, dated Kurnool, 2nd May 1867, No. 114.

1. I have the honour to forward herewith a Comparative Statement of the masonry works in the 4th Section, including all available information about the actual amount of past work.

2. In my No. 414* of 4th September 1866, I endeavoured to explain the past work in the following:—

3. Two "wall culverts" or masked calingulahs in 51st and 54th miles (I think).

One retaining wall near a well in 45th mile.

One temporary bridge in 47th mile. I will say no more about these.

4. With my No. 300* of 25th July 1866, which accompanied complete revised estimate of the work requiring to be done to complete

the masonry works of the 4th Section. I sent a Memorandum in explanation in which I embodied all the reliable information known up to this time about the past work in No. 2 bridge, 8 feet culvert No. 2 (47th mile), 3 feet culvert No. 4 in 50th mile, 6 feet culvert No. 6 in 60th mile.

Three feet culvert No. 1 (44th mile) needs no comment.

Do. do. No. 2 (45th mile) beyond the flooring and thickening of the arch from 12 to 15 inches, nothing requires notice except the excavation. This is an item which is very difficult to explain; and I will here, once for all, point out that some mismanagement seems to have occurred in this and some other culverts, in regard to excavation, both in this and in other Divisions, north-east of a line from Nagatoor through the 110th mile of canal or thereabouts. At certain times of the year (this year in July and August) different climates exist on different sides of this line. Fifteen or twenty inches of rain may fall on one side, while not above three or four have fallen on the other. Hence, the practice of being careless as to whether masonry works were got on with the first thing, or were postponed to any convenient time during the progress of the banks—a practice which had resulted in no inconvenience in the Hindry Division, proved an erroneous one in the 4th and 7th Sections. It resulted in culverts being left until the banks between them were partly raised, and the surface drainage of miles of country concentrated on the

D

ready came down for fortification.

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site of the progressing excavation, and works of the culverts. In these Divisions, the escape channels are heavy works, and were not got out thoroughly before the culverts were commenced. Even an experienced Engineer must have had difficulty with such works, especially where contractors were of the ordinary dilatory stamp, and slow in getting actively to work after the rainy months.

5. Under the circumstances, it is quite credible that the first monsoon might fill up some of the excavations completely, and that delays and want of vigorous measures might result in the work being still unfinished when subjected next year to the same ordeal. The one or two subsequent monsoons which have passed before the inlets were completely bottomed out, must have also brought silt and debris into those channels. Even with the outlet finished, the yet unarched six feet culvert in 60th mile has sifted up to springing this year, though clear of silt before the rains.

6. The average cost of the 6,237 cubic yards of excavation, shown in the records as paid for, is 6½ cubic yards the Rupee. It is impossible now to say positively what were the respective rates for original excavation, and for removing silt, since the two may have been let together at times for an average rate. In the outlet alone, omitting the excavation for the culvert and ingress,

Mr. Wilks finds 2,331 cubic yards. The excavation for the culvert was estimated at 1,396,* so that about 50 per cent. of silt and fallen earth seems to have required removal.

7. In the masonry, Rupees 270 has been overpaid by an error in a cash voucher. Many a gnat has been discovered, and expensively expunged, and yet one camel was able to elude the scrutiny of the Division Engineer and the Agent, and was detected by myself.

Three feet Culvert No. 3 (46th mile).—The chief increase is in arch work, as before, and in face walls which would have been unnecessary, had the canal banks been thrown as close together, as in the original design. The extra works of inlet, outlet, and concrete coating to the culvert, have made nearly Rupees 1,000 addition.

Three feet Culvert No. 4, 56th mile, already described.

Do. do. No. 5, 52nd mile, has been described sufficiently. Total cost Rupees 1,162-13-4.

Eight feet Culvert No. 1, 46th mile.—This is the culvert in which bad work was discovered, and the revised estimate includes something for the emergent repairs. A bill of the work actually re-placed, as its quality was found bad on examination on partly taking down the work, is appended. The rates in the bills for excavation seem to indicate that work was much impeded by silt. When I first saw the culvert, there was above half a yard in it. The culvert lies very deep in the ground, or rather rock.

Eight feet Culvert No. 2—See my previous remark. The rock excavation cost a Rupee a cubic yard, and is now much filled with silt and water. It is abandoned.

Eight feet Culvert No. 3 is under the estimate. The extra work is heavy, however, and is estimated by measurement as 1,512 cubic yards soil, and 4,331 of rock, without allowance for silt.

8. The expense of excavation and masonry is shown at Rupees 6,992-9-5; deducting Rupees 3,066-15-1, the estimated expense of masonry (for the two seem to have got mixed in the certificates by a clerical error), we have Rupees 3,925-10-4 to account for in the excavation; and as our measurement just quoted would give this at 12 Annas a cubic yard for rock, and 5 yds. a Rupee for earth, including only twenty-five per cent. of silt, debris, &c., at the latter rate, the exact detail has not been collected from the actual cash vouchers, and cooly bills.

Eight feet Culvert No. 4 now fourteen feet culvert Pagadiyal. The rate of the excavation has increased since the revised estimate was prepared, and has reached Rupees 1-10-0, and perhaps a supplemental one will be required. The lower part of the excavation proved to be strong, heavy flags, hard to break up, although the stone disintegrates on exposure. The highest contract rate paid has been 8 Annas a cubic yard. The quantities for the Comparative Statement need no comment.

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Eight feet Culvert No. 5.—Of this only excavation has been done, and that by daily coolies. The rain seems to have refilled the excavation frequently, and the cost has become 8 Annas a cubic yard for the excavation, including the repeated clearing of silt.

Six feet Culvert.—See former Statement 21 A, Bridge No. 1. In this bridge one approach has been made about three times, and the other about twice as flat as that estimated, viz., one in sixteen. The quantities, therefore, are trebled for the former, and doubled for the latter. Besides this, the pits close along the toe have had to be banked up. The quantity paid for agrees with these data nearly enough, though the estimate from recent measurement seems to make a deficiency of a fifth.

Bridge No. 2 has been described.

Calingulah No. 1 seems to be all right, except that beam stones seem to have had too full a measurement. But this cannot be certainly estimated now, the work is finished.

Calingulah No. 2—The actual excavation seems to have cost a little above three yards a Rupee, and the masonry Rupees 3-12-0 a cubic yard over all. The quantities of the Certificate are absurdly incorrect; and perhaps some of the cost of masonry has been entered there to excavation.

Calingulah No. 3. Here the excavation, so far as it can be estimated by measurement, has cost 3 yards a Rupee, if the certificate amount be right. The quantity, rate, and amount in the Certificate, are discordant and indicate error in posting it. The (rubble) masonry seems correctly quoted at Rupees 2-8-0 a cubic yard.

Calingulah No. 4 like 8 feet culvert No. 5, proves the serious damage done by rains, and probably the cost of working by daily coolies.

9. The masonry was also done by daily coolies, since no contractor would take the work at its then price; it has cost nearly Rupees 6 a cubic yard over all.

From the Assistant Executive Engineer, to the Executive Engineer, Nagatore Division, dated Puggadial, 21st March 1867, No. 4.

I have the honour to inform you, with reference to a letter No. 259 from the Officer in charge to your address of the 15th February 1867, that the discrepancy in the bill of costs for 3 feet culvert No. 1, and the measurement given, as they now stand, consists merely in the fact that the measurement did not include the amount for excavation.

Bill Cost.			Measurement according to rates.		
67-7 cubic yards at 2	8	0 = 169 7 9	67½ cubic yards at 2	8	0 = 169 7 1
116-74 " at 7	0	0 = 817 14 0	116½ " at 7	1	0 = 817 14 8
113-74 " at 8	0	0 = 909 14 9	113½ " at 8	0	0 = 909 14 9
Add for excavation		990 1 3	Add for excavation		990 1 3
		2,887 5 9			2,887 5 9

There is an omission in the measurement given by me in the Statement for three feet culvert No. 1; the end walls should be (48 × 2 × 5 was left out)

End walls.	
36 × 2½ × 4½ } 33½ at 2 8 0	84 7 1
48 × 2 × 5 } 34	85 0 0

The other errors were made in the original Certificate,* copies of which are herewith forwarded.

These bills and measurements have been signed by Mr. Brooks, and passed by Mr. W. Cotton, and I did not think it necessary to check the calculations, having considered that they must have been duly checked in the Office before payment was made.

The whole of the calculations for the four Statements have been checked by Mr. D'Vaz, and except those mentioned no corrections are required.

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13th June 1867.*

Paragraph 4. As no details are given in the form II, II, it is impossible to explain clearly the differences referred to.

Paragraph 5. Eight feet culvert No. 1.

The amount of cubic yards of earth-work paid for up to September 1865.	RS.
Amount paid for since in inlet and outlet	7,450
	<u>4,893</u>
Total paid for...	12,343
Amount according to measurement inlet and outlet taken from the cross Sections of Mr. Partridge and the body calculations by me from the end Section	8,475
	<u>3,868</u>
Difference ..	

I cannot explain the difference in the amounts, the outlet follows a Vagoo, and it is probable that silt and rubbish may have been removed from time to time formerly, and called excavation.

The whole culvert was finished before I joined this division. The body may have taken out a greater breadth than I have allowed. In the above figures, 4,893, nothing but excavation has been entered, and no extra work is included.

All the particulars asked for in the Chief Engineer's letter, No. 223 of 19th January 1867, have been given as nearly as possible in my letter No. 198 of 15th February 1867 to the Chief Engineer, but all measurements of such rough work, or which cannot really now be measured, are only estimated by me; and I am not responsible for the correctness, although I believe them to be correct.

With regard to the egress road from eight feet culvert No. 1, I beg to forward a Section showing the dimensions of the same.

The preparation necessary for re-commencing the work has been so urgent, particularly as I have had no assistance for some weeks, that I was prevented from answering this letter sooner.

No 83.

Comparative Statement of Masonry Works in 4th Section
to be returned.

Forwarded to the Consulting Engineer in reply to his letters No. 108 of the 11th August 1861, and No. 143 of the 28th September last.

(Signed) F. H. HENSLOWE,

Agent and Manager.

MADRAS,
22nd May 1867.

From the Provisional Chief Engineer, to the Agent and Manager for Irrigation and Canal Company,
Madras, dated Kurnool, 28th July 1866, No. 307.

1. In reference to the 4th Section revised estimates, I have the honour to forward, for the Consulting Engineer's information, the longitudinal Sections (with cross Sections) of three of the outlets of culverts. * I find I under-rated the side-long fall in the 4th Section, where I called it 6 inches in 100 feet and upwards. At all events, these Sections show an average of 9 inches in 100.

* 8 feet Culvert No. 1.
 " " 59th mile (drawing No. 4.)
 6 " " 60th " (" " 2.)

2. I would send the longitudinal Section of the outlets in all cases, if I had them ; but none exist. It is not very easy to guess (for it can only be a guess , the amount of excavation of an outlet down a former *Vagoo*, from the look of the banks when finished.

No. 163.

Copy forwarded to the Consulting Engineer, together with longitudinal Sections of outlets of culverts.

(Signed) F. H. HENSLOWE,

Agent and Manager.

Two Sheets.

MADRAS,
8th August 1866.

*Proceedings of the Madras Government, Public Works Department,
18th June 1867.*

From the Agent and Manager for Irrigation and Canal Company, to the Consulting Engineer,
Irrigation and Canal Company, dated Madras, 15th August 1866, No. 176.

I have the honour to forward a drawing of the proposed site of bridge in the 48th mile to accompany drawing No. 7 of 4th Section revised estimates.

No. 405. ORDER THEREON, 18th June 1867, No. 1,826.

IRRIGATION, No. 17.

IRRIGATION, No. 17.

1. With this letter the Consulting Engineer submits a revised estimate of Rupees 1,82,870 for masonry work in the 4th or Nagatore Section of the Madras Irrigation Company's Main Canal.

2. The original estimate amounted to Rupees 49,481 which was subsequently increased to Rupees 1,10,247, and the excess upon this sum for which sanction is now requested is Rupees 72,623, making the total cost of the Section* Rupees 10,757 per mile exclusive of the necessary earth-work and revetment.

3. Captain Mullins reports that it has been found impossible, in the absence of proper and authentic records, to prepare a correct Comparative Statement of the estimated and actual cost of each item of work, but after a careful scrutiny, he shows that there has been gross irregularity, if not fraud, practised in the measurement and payment for the work upon which the largest excesses have occurred, while the description of work executed has been generally inferior.

4. The explanations furnished by the Chief Engineer are far from satisfactory and His Excellency the Governor in Council feels constrained to remark that the facts which the papers now before him bring to light reflect no little discredit upon the executive management of the Company's operations in the Section of the canal referred to, and he regrets that he has no option but to pass the supplemental estimate of Rupees 72,623.

5. These proceedings will be communicated to the Right Honorable the Secretary of State for India.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,

Secretary to Government:

To the Consulting Engineer for the Madras Irrigation and Canal Company.
 .. Manager for do. do.

Exd. S. T. Augustin.

Consulting Engineers Office
Irrigation & Canal Company
Madras, 30th May 1867.

N^o 14.

From,

Captain J. Mullins, R.E.

To,

Consulting Engineer for I.C.C.

The Secretary to Government

Department of Pub. Works.

Sir,

I have the honor to submit for the con-

sideration of Government the correspondence, estimates, statements, and plans, as per margin,

having reference to the masonry works of the 4th

Section or Nagalore Division of the Madras Ir-

rigation and Canal Company's Main Canal.

The amount originally sanctioned for the

masonry works of this Section was Rupees 49,481.*

Subsequent sanctions increased this sum to Ru-

pees 110,247, and the total of the present revised

estimate is Rupees 1,02,070; the supplemental

sanction required is therefore Rupees 72,623. The

difference between this and the amount shown

in the Chief Engineer's estimate is due to a

slight mistake in the latter, as to the sum al-

ready sanctioned for contingencies.

* Deduct from the amount of 8th Section

1. to the extent of 11,000 Rs. 1866-1867

1. from the extent of 11,000 Rs. 1866-1867

1. to the extent of 11,000 Rs. 1866-1867

1. from the extent of 11,000 Rs. 1866-1867

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1. from the extent of 11,000 Rs. 1866-1867

3. The revised estimate was first received on the 10th August last, and its examination was at once commenced: as however it was found that the Comparative Statement did not exhibit the quantities of work done, and as, without this information, not only was the Statement useless, but it was impracticable to ascertain to what causes the excessive cost of the work already done was due, I at once wrote to the Agent pointing out the omission, and why it was necessary that it should be supplied. On the 13th September I received particulars of expenditure on the Masonry works of the Section and, as the wording of the Chief Engineer's letter seemed to show that he thought they were the only works, the details of which had been omitted, the mistake was noticed, and a list of the works, of which the quantity of work done was not stated, was given.

4. With the Agent's letter N^o 83 of the 22nd instant was received a statement agreeing, with the remarks contained in the Chief Engineer's letter, all the information available regarding the actual amount of past work. The statement is called by the Chief Engineer a Comparative Statement, but it does not give the information which the Statement as denominated are intended

intended to convey, because it shows only the amounts and, in some cases, quantities, of the items sanctioned, and the amount spent without, except in a few instances, details of the quantities of work done, and the latter are essential to a comparison of actual with anticipated results. The preparation of the Comparative Statement, in the form which is required to accompany all applications for supplemental sanction, is an easy matter if a proper record of work is regularly kept, but, in the absence of such record, it is of course most difficult to ascertain what has been done, or to apportion the total expenditure on any particular work to the different descriptions of work which may have been executed. In the case of masonry works the requisite system of record is extremely simple and it might have been expected that any Engineer would have considered it necessary, as a preliminary to each successive payment on account of work done, to cause such work to be measured up and recorded. - It would appear however that whatever arrangements were made for ascertaining, at the time, what progress had been made on the masonry works in this Section, either no records were kept or else they were made in such a way as to be incapable of future reference.

5. The Comparative Statement as originally received, and which from the absence of quantities of work done with the cost of each is useless, except for the purpose of comparing the estimated former and present cost of the works, shews that the masonry works which have most largely exceeded the sum which was supposed to be sufficient are:

	Estimates	
	former	present
1 st Culvert 3 feet, N ^o 2 - 45 th mile	1,400	2,390

The quantity of masonry allowed was cubic yards 21370, the Certificates of work appear to shew that 29527 cubic yards were paid for, and the measurements give 2643 cubic yards. Similarly the excavation entered in the estimate was 1396 cubic yards, that paid for cubic yards 6236, that calculated as performed cubic yards 2740. An explanation of the very great difference it is mentioned that it is probable that some extra earthwork has been included in the larger quantity.

2nd Culvert 8 feet, N^o 1 - 46th mile.

Estimates
former present
Rs. 1,708 - 8,148

 Much of the increased cost is due to the absence of proper provision originally for the excavation of the inlet and outlet channels. The total excavation allowed for was cubic yards 540 and that executed, as ascertained partly by calculation and partly by measurement, was cubic yards 2475. On the other hand cubic yards 13,093 would seem to have been paid for. The Bill of cost

cost, also given in the Statement, shews 792 cubic yards of masonry paid for, while the estimate provides 551 cubic yards, and no explanation is given of the cause of difference which must have been occasioned either by over measurement, or by a wide deviation from the original design.

3rd Culvert 8 feet, N^o 3 - 49th mile.

Estimates
former present
Rs. 4,573 - 9,628

 In this case the excavation is represented as having cost Rupees 5,595 against Rupees 1,370 allowed, while on the other hand the masonry estimated at Rupees 3,067 will amount to only Rupees 2,192, when the work remaining to complete shall have been finished. There can be little doubt, I think, that the records do not shew accurately the actual expenditure on either description of work, for it is most unlikely that the masonry could have been executed at

Rs. 3 1/2 a cubic yard $\frac{2}{3}$ the rate allowed in the estimate.

4th Culvert 14 feet, 53rd mile.

Estimates
former present
1,003 - 9,709

 The information furnished regarding this work is very scanty. Some of the excavation is said to have cost as much as Rupees 1. 10. a cubic yard. The estimate allowed 4,047 cubic yards, of which 2,341 were done, according to the measurements, in and up to April 1865 at a cost of Rupees 837. 15.

Since then cubic yards 903 or, as put down in another place, 1003 cubic yards, were expended by Contractors for Rupees 832-12-1, and I do not see where the expenditure Rupees 1327-14-10, stated to have been incurred for 800 cubic yards done by Coolies has been entered, though from this is deduced the information that an expenditure of Rupees 773-13-6 on coolies represents cubic yards 476 of excavation. Neither the statement nor the Chief Engineer's last letter refer to the masonry of this culvert, but it would appear that instead of cubic yards 991 entered in the Estimate of 1864, that paid for with that remaining to be done amount to cubic yards 1298. - Additional masonry was certainly needed, as was pointed out in para. 5 of my letter of the 24th November 1864. *28th Dec 1864*
83 3576
 No. 155, and the whole of the masonry work done before the size of the culvert was increased had to be taken down and this would add considerably to the total quantity, so that probably the total is not much, if at all, in excess of what was necessary. -

5th Culvert 8 feet 11th 5-59th mile Estimates
former present
4,671 7,890
 The only work done here at the time the revised estimate was prepared was excavation, the quantity being cubic yards 3977 at a cost of 2793 Rupees, the allowance in the estimate being cubic yards 1810, of which 1267 were expected to cost

cost 3 Annas and the rest 6 Annas a Cubic yard.
 6th Bridge No. 1-45th mile Estimates
former present
10397 16,029
 This work is noticed in both the Chief Engineer's last letter, and in the Statement which accompanied it. The increased cost is mainly due to the approaches. The Estimate allowed excavation, which went, or should have gone, into the approaches, Cubic yards 2483 Rupees 380-7-
 a distinct item 13,648 - 11,221-5-8
 Filling over arch and abutments 469 - 58-10-
 do between wings and approaches 14,535 - 2202-14-5
 31,032 - 2993-5-4

Average rate per Cubic yard 1-9 nearly.
 The Sections taken of the approaches and other records make the total of the earthwork executed Cubic yards 29,571, the quantity paid for appears to have been Cubic yards 35,541, and the cost 1 Rupees 7,026-12-8, which makes the average rate 2-2 nearly. Now the pits from which the earth or a part of it was taken were cut within the base of the slopes of the embankments, and so the earth was first unnecessarily taken out, and then had to be filled in again. The rate at which this work was done was, on the average, higher than was necessary, considering that considerably more than half the total quantity - that in the lower part of the approaches could have been done at very nearly the estimate rates. - However admitting the actual rate the proper

proper value of the work would be Cubic
yards 29571.5
Deduct into slopes of hills 1705.5
27866 Cubic yards at 86 Annas

35515 Rupees instead of Rupees 7027.

In his last letter the Chief Engineer mentions that the approaches have been made much flatter than was intended, and that consequently the amount of work has, in one approach, been trebled, and in the other doubled. It will be seen however from the above remarks that the estimate provided considerably more earthwork than the measurements show to have been executed, and it would seem therefore that the Chief Engineer is mistaken.

The excess on Calingulah is considerable.

Calingulah No. 1 - 47 mile	Estimate	Excess
" " " " " "	11,695	16,176
" " " " " "	9401	13,035
" " " " " "	11,041	13,870
" " " " " "	11,641	18,580

Of the increase on No. 1 Calingulah, Rupees 794 are due to additions required to make

the aprons safe, and 1 Rupee 1250 to sluice

shutters with lifting gear. The explanation

regarding the rock are incomplete and

not satisfactory. The estimate allowed

1583 cubic yards of rubble masonry. The

measurements appear to show 1900 cubic

yards nearly 300 cubic yards have been

vide P.M. 4th Dec 1864
No. 3576
16 Feb 1865
35461

* including covering stones

paid for. Now a Calingulah is such a very simple work to measure, that it is difficult to understand why the payment for a single yard in excess of the work done should have occurred, and it is still more difficult to suppose that ordinary care would not have prevented the payment for a very large quantity in excess of what the estimate allowed, or of that which could possibly have found a place in the work.

Calingulah No. 2 is situated within a stone's throw of the residence of the Engineer of the Division, yet 4489 cubic yards of excavation appear to have been paid for, the quantity of work of this kind done being calculated at 1613 cubic yards. The Officer who examined the work, and the Chief Engineer, are agreed that the records are unreliable, and there can be no doubt that fraud has been perpetrated, for it is impossible to believe that with an estimate allowing 1583 cubic yards of masonry, and measurements giving the work done at 1690 cubic yards approximately, the insertion of 3343 cubic yards in the Certificate of work done could have been other than a wilful disregard of fact.

In Calingulah No. 3 the excess, after allowing for extra works, such as sluice shutters with gear &c., is small, and the masonry paid

for

for 50 Cubic yards less than that executed, the excavation on the other hand being half as much again as the measurements give.

Calingulak No. 4 promises to be so expensive a work that, as but a small part of the bog had been built, it would have been advisable to recast the design and provide all the discharging power needed in a more compact form. As on a former occasion, it was pointed out these designs would have done very well had the works been required in a country altogether different to that in which these weirs had to be built, but under the actual circumstances of the site, they have occasioned a great waste of money.

8. Bridge No. 2. Supad, 60 miles. ^{Estimate from proposal} 14,512 - 20,463
Up to the time of the preparation of the estimate, 1 Rupee 10,317 11 8 had been expended and the value of work and materials was:
Excavation 200 Cubic yards at 2 Annas - 25 - - -
Masonry 450 - - - at 5 Rupees 2250 - - -
Rammed filling 490 - - - at 4 Annas - 23 12 - -
Materials - - - 1000 - - -

Total - 3298 12 -
Difference 6,919 Rupees.

The Statement and the Chief Engineer's letter show that many effective measures were taken for wasting money, and the results are what might have been anticipated.

P.M. G. No. 36767
4 December 1868

anticipated from those means. This bridge has more than its share of the incompetence, which unfortunately, for a considerable time, characterised the supervision of the Section, and the review of the Earthwork and revetment revised Estimates abundantly show how gross has been the neglect and carelessness with which the duties of the Executive Engineer, at that time, were carried on, and how entirely his proceedings were uncontrolled. In the future this Bridge is estimated to cost 16,246 Rupees ^{there is an increase of} in which 1 Rupee 5121 is due to the approach and 1 Rupee 1,683 for sundry extra works, including arrangements adopted to make a temporary bridge in anticipation of the expected supply of water from Sornkavala, although above this point there were great gaps in the embankments, of the filling up of which there was no prospect. The Chief Engineer has made some observations on this Bridge in the remarks dated 25th July 1866, attached to the Agent's letter No. 1625. It is not clear why the site of the Bridge was changed, for it is certain that no appreciable advantage to the traffic will result. In the original longitudinal section the site is marked at a point where the Canal was in 2 feet cutting, whereas the plan showing the position of the bridge -

remaining

remaining to be completed makes the cutting one foot at the right abutment, and the ground 4 feet below bed level at the opposite side. The road or track, in connection with which the bridge will be, is not a made road, but simply a cartway through the scrub jungle, and it might easily have been diverted to the original side, which was a few chains higher up the Canal.

With regard to the remarks contained in the Chief Engineer's last letter on the subject of the difference between the quantity of excavation paid for at some of the culverts, and that ascertained to have been executed, all that can be said is that, so far as the supposition, that much of the difference is due to the repeated silting up of the excavation, tends to reconcile the discrepancies, it leads also to the conclusion that there was great want of care in the management of the works. If banks be thrown up across the drainage of a country, and if the only passages left for the water be at the sites of excavations for culverts, and then, if the construction of those culverts be delayed, of course the excavation will become filled in on the occurrence of the first fall of rain. If also when this has

once happened, the Engineer contents himself with clearing out the excavations and leaving them to be again refilled, he evidently needs to be dealt with in some way which would serve to impress upon his mind the personal disadvantages of neglecting his clear duty of providing for the efficient conduct of all the works under his charge. The Chief Engineer instances the silting up of the culvert in the 60th mile to show how much silt does accumulate, but it should be added that there too it might have been readily foreseen that such accumulation was inevitable. The culvert was not commenced, and completed, and the banks closed up to or over it, in one season, which might easily have been managed; but the side walls were built, and the drainage left to go as and where it pleased, and, as the conditions of the channel between the walls and in the outlet were dissimilar to those of the natural drainages, and as the fall in the former was necessarily less than that in the latter, silting was the natural consequence of the arrangements made. There is too another point of some consequence. An Executive Engineer is bound to record all the work for which he expends money entrusted to his care, and he

is especially bound to be careful and particular in recording extra work, and this too of a description, as in the case of this silt, which could not be traced after it had been cleared out. As the Chief Engineer says, "it is impossible now to say positively what were the respective rates for original excavation and for removing silt, since the two may have been let together at times for an average rate," it shows that the Engineer did not take the trouble to ascertain and record what work had to be done, and to fix approximate rates according to the nature of the work.

7. The additional works included in the present estimate are

Retaining wall 4 th Mile	Rupers 92-8	
Temporary bridge 47	"	650-13-2
N ^o 1A Bridge 48	"	6948-1-8
3 ^d Culvert N ^o 4 50	"	2289-4-6
3 ^d N ^o 5 52	"	1162-13-4
N ^o 1 Open wall Culvert 51	"	695-12-9
N ^o 2 54	"	835-4-4
	Rupers	12,674-9-9

as a set off against the above, one Siny boat has been superseded, Rupers 600 - - - There is a balance of the sanction

for the abandoned 8 feet Culvert in the 48th Mile 2355-7-5

Rupers 2955-7-5

8. The retaining wall in the 44th Mile is a trifling work to prevent the rear slope

of the left bank of the Canal interfering with a well. This wall is finished. The temporary bridge in the 47th Mile was built last year, it has not as yet been required and probably it will not be needed at all, unless the construction of the permanent bridge be delayed. However, but for the failure of the banks in the 7th Section, it would have been brought into use last year.

The N^o 1A Bridge is intended to provide a crossing in lieu of the abandoned culvert in the 48th Mile. It is referred to

in my letter as per margin and its construction has not been commenced.

The two 8 feet Culverts in the 50th and 52nd Miles were necessary works, and they have been completed.

The two open wall Culverts in the 51st and 54th Miles were commenced without sanction, were damaged by the first rains which occurred, and were then wisely abandoned after some 1500 Rupers had been expended upon them. Probably had they been completed, and the embankment filled in, they would have occasioned heavy loss, and it is fortunate that works committed to the purpose for which they were designed were carried away before more money had been wasted.

9. The most unfortunate circumstance connected

connected with the large expenditure,
past and prospective, on the masonry
works of this Section is that not only has
money been undoubtedly wasted, but the
work done is in many instances inferior.
With the one exception - the Lupad Bridge
in the 60th Mile - increased cost has not
been caused by superior work, and the only
creditable piece of masonry, which had,
up to my last visit, made much progress,
was the 14 feet Culvert at Puggydial
in the 53rd Mile. It is not practicable
to ascertain now what amount of money
has been unnecessarily expended, first
because it is not accurately known
how much work has been done or what
the work has cost, and secondly because
the Section has been so greatly mis-
managed that it would be very en-
difficult to fix proper rates for the
valuation of the work. Even were it
probable that further investigations
would throw any more light upon those
works of which the present are most
in excess of the former estimates, it
would not be worthwhile to occupy
the Chief Engineer's time, and that of
the Engineer recently appointed to the
Section, in examinations of works and
estimates.

certificates, regarding which enough
has been ascertained to show that the
former were not properly looked after,
and that the latter were prepared in
such a manner as to make them
extremely valuable as records of past
transactions. I beg, therefore, to recom-
mend that the additional sanction
of Paper 72,623 be asked for be given,
to enable the Chief Engineer to get on with
the works.

I have the honor to be,

Sir,

Your most obedient Servant,

Whitcomb Captain

Consulting Engineer P & C

Public Works Department.

1826

PROCEEDINGS of the MADRAS GOVERNMENT.

Under date the 18th June/67.

Read the following

From The Consulting Engineer
M.C.C.

(Here enter No. 11, dated 30th May 1867)

With this letter the Consulting Engineer submits a revised estimate of Rupees 1,82,870 for masonry works in the 4th or Nagas section of the Madras Irrigation Company's Main Canal - The original estimate amounted to Rupees 49,481 which was subsequently increased to Rupees 1,10,247, and the excess upon this sum for which sanction is now requested is Rupees 72,623, making the total cost of the Section Rupees 10,757 per mile exclusive

17 Miles from the 44th to the 60th mile -

Copy on 21/6/67-10/6/67
27/6/67 1825 of 1867

1867
1825
1822

The Consulting Engineer
To the Secretary to Government
M.C.C.

Dated 30th May 1867
1825
1822

Observe for the consideration of Government the correspondence submitted, statement of land with mentioned having reference to the masonry works of the 4th section of the Madras Irrigation & Canal Company's Main Canal.
1825
1822

1825
1822

of the necessary earth work
and rearmament.

Captain Mullins
reports that it has been
found impossible, in the
absence of proper and
authentic records, to prepare
a correct comparative
statement of the estimated
and actual cost of each
item of work, but, after
a careful scrutiny he
shows that there has
been gross irregularity,
if not fraud, practised
in the measurement of
and payment for the
work upon which the
largest expenses have
occurred, while the de-
scription of work executed
has been generally inferior.

The explanations fur-
nished by the Chief
Engineer are far from

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satisfactory, and His Excellency
the Governor in Council feels
constrained to remark that
the facts which the papers
now before him bring to
light reflect no little
discredit upon the Executive
Management of the Company's
operations in the section
of the Canal referred to,
and he regrets that he
has no option but to
pass the supplementary
estimate of \$72,623.

These proceedings
will be communicated
to the Right-Honorable
the Secretary of State
for India -

4 The Consulting Engineer
for the M. S. R. C. - with the fifteen plans &
4 - - - Manager - two sections & plans
of the proposed
improvements

Sept 14/67

Copy in a Letter to England
9/27. July 1835 of 1867

P. W. 1867. Department.

Proc. of Govt. for India
No. 1826

PROCEEDINGS OF GOVERNMENT.

Dated

18th January 1867

Received on a
letter from the Consulting
Engineer, submitting a
estimate amounting to
Rs. 1,82,870 for masonry
works in a navigation
of the Madras Navigation
Canal Company's Canal.

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