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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 2715	Press
611-612	Misr
Dated 28-8-	1866.

Not to be folded or roughly handled

12

Proceedings of the Madras Government, Public Works Department,
28th August 1866.

No. 611. Read the following letter from the Consulting Engineer for Irrigation and Canal Company, to the Secretary to Government, Department Public Works, dated Madras, 2nd August 1866, No. 45:—

1. I have the honor to forward, for the consideration of Government, a letter, No. 87 of the 28th June last, from the Agent and Manager Madras Irrigation and Canal Company, transmitting a copy of a letter from the Chief Engineer proposing to substitute cart and foot bridges for the thirteen ferries sanctioned for the first three sections of the main canal. The plans and estimates of the bridges are enclosed; they reached this office on the 23rd ultimo.

2. The amount actually sanctioned for the Ferries is $13 \times 600 = 7,800^*$ Rupees, but Mr. Latham shows that their actual cost will be about $13 \times 5,000 = 65,000$, and he estimates the cost of the bridges to be—

Five for bandies at Rupees 9,000	...	...	...	45,000
Eight for foot traffic at " 3,000	...	...	...	24,000
And he adds one of the latter for the twenty-fourth mile where there is no ferry	...	...	...	3,000
				<u>72,000</u>

3. The sums thus entered afford a considerable margin on the amounts of the two general estimates for bridges of this class, and perhaps they would prove sufficient on the average.

4. There can be no doubt of the much greater convenience to the people of the District, which the substitution of bridges for ferries would afford. Were these fourteen bridges constructed, there would, with those for the Gooty road, and for Zorapore near Kurnool, be sixteen bridges in forty-three miles, and six other crossings, three under-aqueducts, and three through under-tunnels. The total cost would be approximately—

Two first class bridges at Rupees 12,500	...	25,000
Five second do. do. " 9,000	...	45,000
Nine third do. do. " 3,000	...	27,000
Culvert 9th mile, extra, due to making it a communication, say ...	...	3,320†
Road arrangements under arch of Hindry aqueduct	...	2,698
		<u>1,03,018</u>

Culvert 21st mile, revised estimate	...	6,946
Kadragh aqueduct, say, about one-fifth of total cost.	...	11,500
33rd mile culvert, all	...	9,304
Ullur aqueduct, say one-fourth of Rupees 38,106.	...	9,526
		<u>1,40,294</u>

Total of 22 crossings... 1,40,294

† Progress Report gives no information; but Estimate gives 9,959 as probable cost.

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23th August 1866.*

5. The sanction for the works of the	
1st Section is	Rs.
2nd do. revised estimates are	8,56,777
3rd do. do.	17,97,365
	8,68,420
Total ...	31,62,562

To which would have to be added the difference between the estimated cost of the second and third class bridges and that of the ferries

Works and Communications...	61,200
Works only	35,26,762
Communications only	33,86,463
The latter are 4.14 per cent on the former	1,40,291

6. The average cost of the 22 crossings would be Rupees 6,377, and it appears most of those already provided have cost more than this. Leaving out the two bridges, which are first-class crossings, and the Hindry aqueduct road-way, which did not add at all to the cost of the aqueduct, the average of the remaining five is Rupees 8,119.

7. The Chief Engineer's proposition, therefore, even when compared with ferries furnished with one ferryman only, is not an expensive one. A second ferryman would raise the real cost of a ferry from 5,220 Rupees to 6,820, and it may be remarked also that another additional item would, sooner or later, be small houses for the ferryman.

8. As regards the designs for the bridges, that of the second class with a nine feet road-way is, I think, suitable; both the traffic over it and that under it are sufficiently provided for. The expense might be somewhat reduced by making the head-way, under the centre arch only, equal to the standard of fifteen feet clear above the water: this would reduce the head-way under the side arches to 13 feet 9 inches, which would usually be sufficient for boats in tow.

9. The design for the third-class bridge, with a five feet road-way, cannot be recommended, because, as Mr. Latham remarks, a towing path cannot be carried through it. The twenty-five feet arches are too small to give room for both tow-path and boat, added to which there is no water-way to spare. It is certain that within a few years it would be found essential to arrange for passing these bridges without casting off the tow line, and it would only lead to a greatly increased expense were any design adopted now which ignored this necessity. Without a tow-path a bridge of this sort would injure the canal more than its substitution for a ferry would benefit the people. It is no doubt far from easy to design a bridge which shall meet the wants of the canal and the country, and be at the same time not more costly than a ferry, for an essential of a cheap bridge of the arched form is the reduction of

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23th August 1866.*

span from centre to sides, so as to avoid heavy abutments, long wings, and high embanked approaches. Perhaps the problem could be solved by the use of plate girders, two 50-feet spans of which would suffice, and steps at either end at one and a half to one would do for foot passengers, and prevent the approaches being expensive.

Fairbairn's formula $W = \frac{C \cdot d}{L}$, with four times the probable weight, or $6\frac{1}{2}$ tons, on a span for W, gives, with depth of web 16 inches, a bottom flange of $3\frac{1}{2}$ square inches, top flange say $6\frac{1}{2}$ square inches and web $3\frac{1}{2}$. Such a girder would for a length of 56 feet weigh $1\frac{1}{2}$ tons, and cost about 280 Rupees.

10. I would recommend, therefore, that until a design for the third class bridges is prepared, which will, at a moderate cost, afford as good accommodation to the land traffic as a ferry, and not injure the capabilities of the canal for navigation, the question of doing away with the ferries at the points where these third class bridges are proposed to be built, be postponed.

11. As regards the second class bridges, I am not quite sure that one for Dúdiyala* is a necessity, but I am sure the second for Yedarur† will be a great convenience, as also the last but one at

the 39½ mile. The others I shall be able to speak more certainly about after my next visit to the canal, and I beg to suggest, therefore, that the Chief Engineer be informed that estimates for second class bridges in supersession of ferries at Yedarur and Malayala may be at once prepared, and that the other three localities proposed will be considered after they have been examined by me with special reference to their suitableness for bandy crossings, and I will consult the Collector and Executive Engineer on the subject.

12. As bridges cannot be built this season any where, I have requested the Chief Engineer to take care that the means of cross communication already approved are made available for the present.

From the Agent and Manager, Madras Irrigation and Canal Company, to the Consulting Engineer, Madras Irrigation and Canal Company, dated Madras, 28th June 1866, No. 87.

I have the honor to transmit copy of a letter from the Provisional Chief Engineer, proposing to substitute light bridges for ferry boats for the minor crossings of the Company's Canal, and to request you will have the goodness to obtain the sanction of Government to the measure.

No. 162 of 18th June 1866.

P. S.—The estimates and tracings referred to in the third paragraph of Mr. Latham's letter will be forwarded immediately on receipt.

From the Provisional Chief Engineer, to the Agent and Manager Madras Irrigation and Canal Company, dated Kurnool, 18th June 1866, No. 162.

Minor Crossings.

1. At the time the canal was being originally laid out, the Government, in their Orders marginally noted, expressed a preference for crossings under the canal, rather than over. The great height of a bridge is certainly an objection for cart traffic. The Company has gone to great expense in enlarging culverts in

1. Kurnool District Engineer's No. 132 of 6th June 1861, see G. O. —
2. G. O. recording Consulting Engineer's No. 25 of 5th September 1861.
3. G. O. No. 1,748 of 20th September 1861.

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28th August 1866.*

order to make crossings as described in the G. O., and in the accompanying letters of the District and Consulting Engineers of the time. Where culverts were inadmissible ferries were adopted.

2. The expense of these last proves heavier in effect than was at first anticipated. A ferry was estimated to cost Rupees 600. But in practice the boat costs that; the ramps or approaches and the ford necessary to keep the road open during times of low water also cost money, and the ferryman is a constant expense. As foreseen by Captain Beatty, wooden boats require constant repair. I fear iron ones would, and a trifling repair to iron work requires expensive workmen.

3. On the whole, I think the under-stated estimate moderate. In fact, no ferry with ramps and ford has been properly maintained yet:—

1. Ferry boat Rupees 600, present value ...	Rs. 600
* This is under the mark. 2. Renewal 15 per cent.* Rupees 86 a year or do. at 20 years' purchase.	1,720

3. Ramps, of which, say, 40 to 50 yards are in the water and require good metalling and repair roadway 1 in 16, say ... 300

4. One Ferryman, rope, and tools Rupees 80 a year, or present value ... 1,600

5. Re-caulking ferry boat and annual repairs Rupees 50 a year, do. ... 1,000

Total... 5,220

and what an inconvenient thing it is after all.

4. Now I would divide ferries into two classes:—

I. Those for farmers' field accommodation. These need no accommodation beyond a good foot-way or bridle-path. I enclose a couple of tracings and estimates for a bridge over the canal, which will, on the average, cost Rupees 3,000 or under, and when up need no repairs nor attention.† Its cheapness is due to its having no approaches, (for foot passengers can go up a rough stairway of stone at 1 in 2, and bullocks and horses also,) and to its narrow width of 50 clear road-way, and to its light construction.

II. Those along which the produce is carted from village to village. A bridge with approaches with 90 clear road-way would cost about Rupees 8,000 (that at Nagatoor will cost less, stone being on the spot), and the approaches Rupees 2,000, if 8 yards wide at top and 1 in 16 slope and with disadvantageous ground. Let us assume that in the first five sections when the canal is broad a

Ferry costs ...	Rupees 5,000
A Bridle bridge...	3,000
A Bandy bridge...	9,000

5. Hence, if ferries be abolished, and for every three ferries abolished one bandy bridge and two bridle bridges be substituted, the Company will be no loser. The obstruction and danger of ferries will be avoided. The bandy bridge has a towing path under the arch. The bridle bridge cannot have; but it is only 8 feet wide, and has a total aggregate span of water-way of 114 feet, including the side arches, which are only partly available for water. Moreover, its traffic arch is a very fine one of 40 feet span and 16 feet headway.

6. Of the ferry estimate in my paragraph 3, items 1 and a small part of 3 have been generally spent, and items 4 and 5 have been borne in ordinary course. Some ferries are still unprovided with boats. With the Consulting Engineer's approval I shall be glad before further expense is incurred to arrange with Superintending Engineer and Collector, and build bridges instead of ferries at the rate of two of the smaller kind, at least, to one of the larger.

7. Meantime, I find the following ferries proposed, so far as I can ascertain. I add in a column the bridges I would substitute.

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I SECTION.

Mile.	Villages for which Ferry is provided.	Average cost.	Bridges proposed.	Average cost.
		RS.		RS.
1 in 4 f. ...	Koontalapad to a few fields...	5,000	Bridle ...	3,000
2 in 3 f. ...	Doodyala to dry land and Kurnool...	5,000	Bandy ...	9,000
5 in 1 f. ...	Yedooroor to a few fields ...	5,000	Bridle ...	3,000
6 in 1 f. ...	Do. to dry land and Kurnool...	5,000	Bandy ...	9,000
11 in 1 f. ...	Niddajood and fields...	5,000	Bridle ...	3,000
12 in 0 f. ...	Do. do. ...	5,000	Do. ...	3,000
13 in 3 f. ...	Moogalapad and fields ...	5,000	Do. ...	3,000
15 in ...	Do. ...	5,000	Do. ...	3,000
Total, 1st Section...		40,000		36,000
II SECTION AND III SECTION.				
19 ...	For evening drive of English Residents.	5,000	None.	
24 ...	Cattle track, Soodrawoo ...	Nil.	Bridle ...	3,000
29½ ...	Poodoor to Nundicotakoor ...	5,000	Bandy ...	9,000
31½ ...	(R.) ...	5,000	Nil.	
34½ ...	Sultanpoor, Kistna, and Nundicotakoor.	Nil.	Bridle (since Uloor aqueduct and 13 feet tunnel.)	3,000
37½ ...	Shaitankota and Nundicotakoor ...	5,000	Bandy ...	9,000
39½ ...	Muliyala to Nundicotakoor...	5,000	Do. ...	9,000
41st ...	Do. to Mundeleur ...	5,000	Bridle ...	3,000
Grand total, Ferries...		30,000	Bridges...	36,000
		70,000		72,000

8. For many ferries it is possible Government may insist on having two ferry men. If one be sick the other would work. After ferrying across foot passengers all day a man will be unfit for ferrying across strings of bandies which travel all night; and the work near the time of full moon might be too much for one man.

9. It is to be considered that if a ferry be found unsatisfactory complaints will be made, and, as at Zorapore, Moommurri (where bridges have been ordered), Pagadiyal, &c., the Superintending and District Engineers for the time being may speak of the communications as quite unfit for the requirements, and "only fit for pigs and buffaloes." And experience shows that Government are liable to pass an order for a bridge upon such representations. If then, any but a road bridge were proposed, they would say, let us have no more makeshifts but a good road bridge.

10. If a bandy arrives at a well ordered ferry with a Rupees 600 boat, the bullocks are taken out, and the bandy lugged on to the boat, and it runs a serious chance of slipping, as the boat (being small) tips, between the boat, and the bank. Boats on to which bullocks could be got to pull a bandy, and strongly railed so that when restive they could not get off, would have to be very large, and be very much in the way, and a great expense.

11. If you think that with our restricted expenditure it would be a lighter expense for the next five years to stick to ferries, and run the chance of Government approving them, I will complete them. If you agree with me I recommend that my list of ferries with my proposed substitutions be submitted at once to the Consulting Engineer for Government sanction.

(True Copy.)

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

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28th August 1866.*

No. 612.

ORDER THEREON, 28th August 1866, No. 2,715.

CIVIL WORKS, No. 89.

1. With this letter the Consulting Engineer for the Madras Irrigation and Canal Company submits, for consideration, a proposal from the Chief Engineer to substitute cart and foot bridges for the thirteen ferries which were sanctioned for the first three Sections of the Main Canal.

2. The cost of the ferries was originally estimated at Rupees 7,800, but the Provisional Chief Engineer explains that they have proved much more expensive than was anticipated. He now estimates their cost, inclusive of charges which have necessarily to be incurred, at Rupees 65,000, and, considering the much greater convenience which bridges would afford, he recommends their construction in lieu of ferries at an expenditure of Rupees 72,000.

3. The Consulting Engineer is in favor of this measure; but for the reasons stated in paragraph 9, he objects to the plan of the third class bridges proposed by the Company's Officers, and suggests that, until a more suitable design can be prepared, the abandonment of the ferries at the points where it is proposed to build this class of bridges, should be postponed, and, as the necessity for all the second class bridges does not seem quite apparent, he further recommends that, pending his inspection of the localities and a personal conference with the Collector and Executive Engineer, the preparation of estimates should be confined to the second class bridges required at Yedarúr and Malayala.

4. The Government approve of these proposals and direct that they be adopted. The attention of the Chief Engineer will be drawn, through the Manager, to the suggestions in paragraph 8 for reducing the cost of second class bridges.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government

To the Consulting Engineer, Madras Irrigation and Canal Company, with five Enclosures.
do. do. do.

Exd. S. T. Augustin.

Consulting Engineer's Office
Irrigation Canal Company
Madras, 2nd August 1866.
N^o 45

From,
Captain, J. Mullins, R.E.
Consulting Engineer for I.C.C.

The Secretary to Government
Department Pub Works.

Enclosure see
1. Plan
1. Estimate
1. Letter to letter
in original
28.8.1866

1. I have the honor to forward for the consideration of Government a letter, No. 87 of the 28th June last, from the Assistant Manager Madras Irrigation and Canal Company, transmitting a copy of a letter from the Chief Engineer proposing to substitute cart and foot Bridges for the 13 ferries sanctioned for the first 3 sections of the Main Canal. The plans and estimates of the Bridges are enclosed. They reached this office on the 23rd ultimo.

2. The amount actually sanctioned for the ferries I have deducted the too is $13 \times 600 = 7,800$ Rupees, but Mr. Vatham shows allowed for the ferries provided by the proposal that their actual cost will be about $13 \times 5,000 = 65,000$, and he estimates the cost of the Bridges to be
5 for handies at 9,000 = 45,000
8 for foot traffic at 3,000 = 24,000
and he adds of the latter for the 24 miles 3,000 where there is no ferry 72,000

3. The sums thus entered afford a considerable margin on the amounts of the two general estimates for bridges of this class, and perhaps they would prove sufficient on the average.

4. There can be no doubt of the much greater convenience to the people of the District, which the substitution of bridges for ferries would afford. Were these 14 bridges constructed there would, with those for the Lark Road, and for Horapora near Kurnool, be 16 bridges in 43 miles, and 6 other crossings, 3 under aqueducts and 3 through under tunnels. The total cost would be approximately

2 first class bridges at 12,500 = 25,000
5 2nd do do 9,000 = 45,000
9 3rd do do 3,000 = 27,000
Culvert 7th mile, extra due to making it a communication say } 3,320
Road arrangements under arch of Hindry Aqueduct } 2698
Culvert 21st mile revised Est. 6,946
Kadraugh Aqueduct say about 1/5 of total cost } 11,500
33rd mile culvert all 9,304
Ullur Aqueduct say 1/5 of Rs. 38,106 9,526
Total of 22 crossings 1,40,294

Progress Report gives no information in estimate since 9959 as probable cost

5. The sanction for the works of the 1st Section is Rs. 8,56,777
2nd do revised estimates are 17,97,365
3rd do do 8,08,420
Total 34,62,562
To which would have to be added the difference between the estimated cost of the 2nd and 3rd class Bridges and that of the ferries 64,200
Works & communications 35,26,762
Works only 33,86,468
Communications only 1,40,294

The latter are 4.11 per cent on the former.

6. The average cost of the 22 crossings would be Rupees 6,377, and it appears most of those already provided have cost more than this - leaving out the two Bridges which are first class crossings, and the Hindry Aqueduct roadway which did not add at all to the cost of the aqueduct, the average of the remaining 5 is Rupees 8,119.

7. The Chief Engineer's proposition therefore, even when compared with ferries furnished with one ferry-man only is not an expensive one. - A second ferry-man would raise the real cost of a ferry from 5,220 Rupees

3. 5220 Rupees to 6820, and it may be remarked also that another additional item would, sooner or later, be small houses for the ferry men.

8. As regards the designs for the Bridges that of the 2nd class with a 9 feet roadway is, I think, suitable; both the traffic over it and that under it are sufficiently provided for. The expense might be somewhat reduced by making the headway under the centre arch only equal to the standard of 15 feet clear above the water: this would reduce the headway under the side arches to 13'-9" which would usually be sufficient for boats in tow.

9. The design for the 3rd class Bridge with a 5 feet roadway cannot be recommended, because, as Mr. Nathan remarks, a towing path cannot be carried through it. The 25 feet arches are too small to give room for both tow path and boat, added to which there is no water-way to spare. It is certain that within a few years it would be found essential to arrange for passing these bridges without casting off the tow line, and it would only lead to a greatly increased expense were any design

design adopted now which ignored this necessity. Without a tow path a bridge of this sort would injure the canal more than its substitution for a ferry would benefit the people. It is no doubt far from easy to design a bridge which shall meet the wants of the canal and the country, and be at the same time not more costly than a ferry, for an essential of a cheap bridge of the arched form is the reduction of span from centre to sides, so as to avoid heavy abutments, long wings and high embankment approaches. Perhaps the problem could be solved by the use of plate girders, two 50 feet

Strauss's formula $W = \frac{C \cdot d^3}{L}$, with 4 times the probable weight, or 6 1/2 tons, spans of which would suffice, and steps at either end at 1 1/2 to 1 would do for foot passengers and prevent the approaches being expensive. Such a girder would for a length of 56 feet weigh 18 tons and cost about 280 R.pees.

10. I would recommend therefore that until a design for the 3rd class bridges is prepared which will, at a moderate cost, afford as good accommodation to the land traffic as a ferry, and not injure the capabilities of the canal for navigation, the question of doing away with the ferries at the points where these 3rd class bridges are proposed to be built be postponed.

11. As regards the 2nd Class Bridges I am not quite
sure that one for Mudiyalu is a necessity, but I am 2 miles & 3 furlongs -
sure the 2nd for Yedariu will be a great convenience 56 miles & 1 furlong -
as also the last but one at the 39¹/₂ mile. The others
I shall be able to speak more certainly about after
my next visit to the canal; and I beg to suggest there-
fore that the Chief Engineer be informed that esti-
mates for 2nd Class bridges in supercession of ferries
at Yedariu and Malayala may be at once prepared,
and that the other 3 localities proposed will be
considered after they have been examined by me -
with special reference to their suitableness for
handy crossings, and I will consult the Collector and
Executive Engineer on the subject.

12. As bridges cannot be built this season -
anywhere, I have requested the Chief Engineer to
take care that the means of cross communication
already approved are made available for the present.

I have the honor to be,
Sir,

Your most obedient servant,

Wm. Miller Captain R.E.

Covering for S.H. Company -

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Public Works Department.

2122715

PROCEEDINGS of the MADRAS GOVERNMENT
Under date the 28th Aug 1866
Read the following

From the Chief Engineer
I. & C. Compy. (Here enter No. 45 dated 2^d Aug 1866)

With this letter the Consulting Engineer for the Madras Irrigation and Canal Company submits for consideration a proposal from the Chief Engineer to substitute Cart and foot bridges for the 13 ferries which were sanctioned for the first three sections of the Orain Canal.

The cost of the ferries was originally estimated at Rs 7,800, but the Provisional Chief Engineer explains that they have proved much more expensive than was anticipated. He now estimates their cost, inclusive

W.M.

27 1866 24th

From the Chief Engineer
I. & C. Compy. 28th Aug 1866

To the Secretary to Govt.
D. P. P.

Read 27th
28th Aug 1866
A. 245.

Enclosures 5

Towards for the consideration of Government a letter of the 28th June last transmitting a copy of a letter from the Chief Engineer proposing to substitute Cart and foot bridges for the 13 ferries sanctioned for the first three sections of the Orain Canal.

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2122715-28th Aug 1866

of charges which have necessarily to be incurred, at Rs 65,000, and considering the much greater convenience which bridges would afford, he recommends their construction in lieu of ferries at an expenditure of Rs 72,000.

The Consulting Engineer is in favor of this measure; but for the reasons stated in Para 9, he objects to the plan of the 3^d Class bridges proposed by the Company's officers, and suggests that until a more suitable design can be prepared, the abandonment of the ferries at the points where it is proposed to build this class of bridges, should be postponed, and as the necessity for all the 2^d Class bridges does not seem quite apparent,

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he further recommends that pending his inspection of the localities and a personal conference with the Collector and Executive Engineer, the preparation of estimates should be confined for the present to the 2^d Class bridges required at Yetari and Marayala.

The Government approve of these proposals and direct that they be adopted. The attention of the Chief Engr will be drawn, through the Managers, to the suggestions in Para 8 for reducing the cost of 2^d Class bridges.

To
The C. Engr in I. & C. with
1/2 Manager for do.

16
Sept 29th Aug

(1)

P. W. 1866. Department.

Proc. of Govt for August

No. 21/5

PROCEEDINGS OF GOVERNMENT

of Madras

Dated 28 August 1867

Under C.P. 3864/186

Issuing certain
instructions relative to the
proposed substitution of
Bridges for the first three
Sections of the Irrigation
Company's Main Canal
for Ferries.

ABN-612

1867 2d Oct 1866 Pa. 17th