(1) பக்கங்களின் எண்ணிக்கை 32

(2) புதுக்கித் திருப்பிய நாள் 1.90

(3) ஆதாரங்குறிப்பவர் சுருக்கொப்பம்

தமிழ்நாடு ஆவணக் காப்பகம்.

㉛

தமிழ்நாடு அரசு

P. W. D. துறை

அரசாணை எண்.
மு. கோப்புத் தாள் எண். 3541

அச்சகம்
பலவகை

நாள் : 12-12-1889 ~~198~~.

மடிக்கவோ கண்டபடி கையாளவோ கூடாது

16. Sheets

ஆவண. கா-1—18,006—15-6-87.

3541

12TH DECEMBER 1889, No. 3541 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers:—

From S. H. WYNNE, Esq., President, District Board, South Canara, to the Superintending Engineer, IV Circle, Coimbatore, dated Mangalore, 11th November 1889, No. 1825.

I have the honor to resubmit herewith the plans and estimate for the construction of an iron lattice girder bridge over the Adhoor stream on road No. 8 returned with your letter No. 63 M., dated the 26th February last, and to request that you will be so good as to submit it for the sanction of Government as early as practicable.

One abstract of iron work.
One detailed estimate.
One abstract do.
One specification.
One report.
Two plans.

2. As regards the advisability of diverting the stream as suggested in para. 4 of your letter under reply, I have the honor to enclose an extract from the Local Fund Engineer's letter on the subject.

3. The iron work required for the bridge will be procured through local agency, as under G.O., dated 20th July 1889, No. 1964 W., it is not incumbent upon Local Boards to adopt the type designs for iron bridges.

4. The current year's budget provides an allotment for the bridge work, and it is very desirable that it should be utilised before the close of the year. I have the honor therefore to request that you will be so good as to submit the estimate to Government as soon as possible for their early orders so that iron work may be finished and received from England before the next monsoon.

No. 520 E.W.

Copy forwarded to the Chief Engineer, Public Works Department, for early sanction of Government.

2. An extract (para. 4) from this office letter No. 63 M., of 26th February 1889, to the President, District Board, and the Local Fund Engineer's observations thereon, are herewith forwarded for the information of the Chief Engineer.

3. The undersigned sees no objection to the design and estimate and recommends that Government will be pleased to accord their sanction to the work as soon as possible to enable the Local Fund Board to utilise the grant for the same in the current year's budget before the end of March next.

COIMBATORE,
21st November 1889.

(Signed) D. McN. CAMPBELL, Major, R.E.,
Superintending Engineer, IV Circle.

Note by the Chief Engineer, P.W.D., General Buildings and Roads Branch.

The question regarding the "skew" of the proposed bridge has already been discussed by the Superintending Engineer, IV Circle, and the District Board, and the balance of the argument is in favor of a "skew" bridge.

1/123

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated December, 12th.

Recd. *Encl.*

G.O., 12th Dec. 1889, No. 3541 W.

DECEMBER.

Bridge over the Adhoor Stream, South Canara District

Estimate, amounting to Rs. 7,000, for constructing an iron lattice girder — on road No. 8 from Kásaragód to Jalsoor, sanctioned.

3541

20th July 1889, No. 1964 W., Public Works.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following paper:—

From H. M. WINTERBOTHAM, Esq., President, District Board, Malabar, to the Chief Secretary to Government, dated Calicut, 26th May 1889, No. 785.

With G.O., dated 10th August 1888, No. 1479 L., Local and Municipal, were forwarded, for adoption, certain standard designs furnished by the Secretary of State for iron bridges. I will refer to these hereafter as the new standard plans.

2. Mr. Anderson, the Board's Engineer, has made the construction of iron bridges a special study, and has shown himself, by the many iron bridges which he has designed and erected for this Board, to be an expert competent and entitled to criticize even designs of such high authority.

3. I beg to submit, for the consideration of Government, a memorandum drawn up by Mr. Anderson, in which he points out certain apparent defects in the new standard plans, and urges that the enormous loads which are provided for will never in fact come on the bridges, and that the acceptance of the designs will therefore saddle the Board with a great, and quite unnecessary, increase in the cost of construction.

4. The new standard plans provide for carrying a crowd-load of 120 lb. to the square foot, and for the crossing of elephants and of the heaviest field artillery.

5. Mr. Anderson advises that for Malabar it is sufficient to design our iron bridges to carry the following loads:—

Bridges with spans under 40 feet	120 lb. per sq. ft.
With spans from 40 to 100 „	80 „ „
Do. 100 to 152 „	70 „ „

Each class of bridge to carry a wheel-load of $2\frac{1}{2}$ tons.

In statement A, Mr. Anderson shows that 78 iron bridges have been built on his designs, approved from time to time by Government in the Public Works Department, and that to have put these up on the new standard plans would have cost the Board an additional $1\frac{1}{4}$ lakhs of rupees.

In statement B, Mr. Anderson shows that the erection, on the new standard plans, of 48 important bridges (urgently required but not yet taken in hand for want of funds) will put the District Board to an unnecessary outlay of over $3\frac{1}{4}$ lakhs of rupees.

Lastly, in statement *D*, Mr. Anderson shows that there already exist in Malabar 5,106 masonry bridges, 263 wooden bridges and 86 iron bridges, not more than about a score of which are calculated to support the load for which the new standard plans provide.

6. I cannot help expressing my strong conviction that the new standard plans are quite unnecessarily massive and costly, and that to impose them on the Board will greatly retard the bridging of the district.

7. Is it necessary or expedient to provide for the passage of 64-pounder guns on wrought-iron carriages, or for elephant? If so, what is to be done with our 5,400 bridges and culverts which are not adapted for this traffic? In a chain of 5,000 links, what is the use of making a few links, here and there, twice as

3

strong as the rest? I would respectfully urge that the passage of heavy artillery is a contingency so improbable that it need not be provided for. As regards elephants, the difficulty is more real, but fortunately the custom of the district, and the wisdom of the elephants combine to prevent their passing over our bridges. Unless goaded to desperation, nothing will induce an elephant to set its foot on the wooden platform of a bridge; and the occasions on which an elephant has been forced across a bridge are so rare, and the danger is so well understood, that it is still universally believed to be punishable as an offence. Even when the elephant comes to a small masonry culvert it habitually makes a detour. Large streams and rivers it crosses by fording or swimming.

8. The legal advisers of Government held that a permanent order prohibiting the passage of elephants over bridges in Malabar could not be legally notified by Government under section 144 of the Code of Criminal Procedure (*vide* G.O., dated 10th May 1888, No. 1088), but I take it that the District Board, when opening a bridge for traffic, may notify that it is not intended for the passage of elephants, and that any person taking an elephant on to the bridge in the face of such notice, and against the custom of the district, might be convicted of criminal trespass. Elephants in Malabar are used for hauling timber from the forests, but never as beasts of burden on the roads except by the Commissariat Department. To build special bridges for elephants, which will never use them, would be sheer waste of money.

9. The defects pointed out by Mr. Anderson in the standard designs are—

(*a*) the use in the smaller bridges of trough floor-plates filled in with broken stone for the floorway (in place of a timber platform) unnecessarily increasing the weight of the floorway and of the material to support it;

(*b*) the use of granite bed-stones with dove-tail sockets, instead of the timber bed-plates hitherto used, and which are adopted even for small bridges on the railways. In a district like Malabar, where small timber is everywhere plentiful and cheap, Mr. Anderson's wooden platforms and wooden bed-plates would seem to be clearly preferable, both on the score of economy and facility of construction and repair.

10. In para. 20 Mr. Anderson points out an apparent error in the drawing of the planking in the designs for spans of over 40 feet which seems to be a slip on the part of the draughtsman, but which might lead to awkward results. The $4\frac{1}{2}$-inch planking should apparently be laid transversely, and the $1\frac{1}{2}$-inch planking above it longitudinally.

11. Seeing the very heavy extra cost which the acceptance of the new standard plans will throw upon the District Board, I would respectfully beg that the subject may be further investigated with a view to determine whether the lighter and cheaper class of bridge, advocated by Mr. Anderson for Malabar, does not amply provide for the very heaviest traffic that can, in all human probability, be expected to come upon it. I need hardly remind the Government that Mr. Anderson's designs for the Iritti and Merumpoya bridges were approved by Government, and that the Secretary of State made a tender to supply the iron-work.

ENCLOSURES.

Office note from G. ANDERSON, Esq., M.I.C.E., District Engineer, District Board, Malabar, to the President, District Board, Malabar, dated Calicut, 20th May 1889, No. 527.

After a very careful examination of the type-drawings supplied by Secretary of State for road bridges—*vide* G.O., 4th June 1888, No. 1025 L., Local and Municipal, and No. 2295 L., of 6th December 1888—and preparing estimates of quantities and costs of iron-work required for same, I find the costs so enormously in excess of the actual cost of bridges, recently erected to my designs that I am forced to request you to ask Government to allow my designs to be adopted throughout the district.

2. I have the honor to invite your attention to the accompanying statement A, from which it will be seen that for the whole of the seventy-eight iron bridges including Iritti and Merumpoya completed up to date, according to designs prepared by me—entirely outside of office hours—a saving of *Rs. 1,28,000* has been effected compared with cost, if works had been carried out according to the type-designs and estimates supplied by Secretary of State.

3. For determining the dimensions and weights of the structures, as shown on the type-designs referred to, it is observed that Mr. James provides for a crowd-load of 120 lb. per square foot, or for artillery and elephants.

4. When I took up the design of bridges for Malabar, the matter of providing for concentrated loading was duly discussed with the President; and it was decided that no provision for passing elephants over any of our bridges should be made.

5. The weight of an elephant is 72 cwt., and this load may be concentrated on a central length of 6·5 feet of any beam causing equivalent central dead loads, ranging from 4·4 tons on 5-feet spans to 6·75 tons on 32-feet span on any single beam; while the 64-pounder on wrought-iron carriage and 7″ B.L. guns and carriages weigh respectively—

	CWT.
on two fore wheels	22
two hind do.	83
and two fore wheels	34
two hind do.	78

loads such as are adopted only for highway bridges carrying heaviest classes of city traffic.

6. The bridges as now designed by me are equal to the following loadings:—

(*a*) *The Iron Trusses.*—Everyday working loads of 80 lb. per square foot, and 5 tons per axle which would more than meet field artillery requirements up to the 40-pounder gun, while with the admissible smaller factor of safety for such temporary or occasional service, in case of emergency, we can carry the heaviest classes of artillery, viz., 64-pounder gun carriage and horses, or a crowd of 120 lb. per square foot of roadway and also elephant. All guns heavier than the field 40-pounder, which would have to be run across the bridges by hand, or hauled over by means of ropes and tackle, or a packed crowd of 100 or 120 lb. per square foot, would of course be considered as a dead load; mere vibration might be caused by either of these loads, but no oscillation which could only be caused by the whole mass of the load lifting and pitching, could be set up sufficient to warrant their being taken as live loads.

(*b*) *For all simple rolled beam (Iron) Bridges* up to 32-feet span, the safe working crowd loading is 120 lb. per square foot. As already pointed out, this loading cannot be taken as "live" for the simple reason that the crowd is packed so close that no motion sufficient to cause the whole mass of the crowd to rise sufficiently simultaneously could be got up. The design, size and weight of beams and platform in this case is governed by the heavy wheel loading which may at any time come upon any single beam; and thus the beams and platform are equal to the heavy crowd loading named which is 20 per cent. more than the best practice of the present day either warrants or adopts for such bridges. These bridges will also safely carry 1·75 tons live load per wheel (3·5 tons per axle) at centres of each beam, and therefore quite equal to carrying the ordinary field 40-pounder gun carriage (1·3 tons per hind wheel or 2·6 tons per axle and only 0·62 tons per fore wheel or 1·25 tons per axle) and horses. In cases of emergency, for temporary or occasional loading, with the admissible smaller factor of safety, or, say, higher working strains, they will safely carry the heavier classes of guns 7″ B.L. weighing 78 cwt. on slides, the 64-pounder on wrought-iron carriage or the steam sapper and elephant.

(*c*) *All Rail Girder Bridges.*— Five to 22 feet span will safely carry 120 lb. per square foot of roadway, or the 40-pounder field gun. To make these structures fit to carry heavier temporary loads, such as elephant and heavy artillery 64-pounder or the 7″ B.L. guns in cases of emergency, a simple trestle must be erected at centre of each span. The cost of strengthening the whole of the bridges in this class (rail girders) would be about Rs. 2,000, and the work could be completed within 48 hours after notice was received.

7. It is observed that the type-designs submitted for all bridges under 30-feet span provide for a ballast covering, weighing 10 cwt. and $6\frac{3}{4}$ cwt. per foot run of bridges having, respectively, 14 and 9 feet roadways. In rail road bridges of small span subjected to heavy loads, compared with the mass of supporting structures, travelling at speeds of 30 to 60 miles per hour, it is advisable and customary to use such dead weight; but, with such loads and service as we have to provide for, even the most trying, viz., the 40-pounder gun carriage, it must simply be looked upon as an encumbrance that calls for a large and unnecessary addition—about 40 per cent.—to the whole weight of the iron work in the bridges, and nearly 70 per cent. in excess of the metal required to carry the moving load, and this too without giving any benefit in return. This can be more easily understood when it is considered that the loading adopted by Mr. James is 120 lb. per square foot or 9·65 cwt + ballast 6·75 cwt., thus making a total of 16·40 cwt. per foot run, or a difference of 7·40 cwt. in excess of the loads (crowd 100 lb. =

8 cwt. + planking 1 cwt. = total 9 cwt.) I have adopted and usually considered necessary, in the best practice of the present time for bridges under 30-feet span in such outlying and non-manufacturing districts as Malabar.

8. In the case of bridges over 40 feet and up to 100 feet span, the loading usually considered necessary, and adopted by me, is 80 lb. for outlying districts like Malabar, ranging up to 100 or 120 lb. in cities, while for bridges over 100 and up to 200 feet span, the loading ranges from 70 lb. in outlying districts to 80 lb. per square foot of roadway in manufacturing districts or towns.

9. Mr. James seems to think that bridges should be designed for an all round standard crowd-loading of 120 lb. for spans above 40 feet and up to 152 feet, irrespective of length of span, locality or description of traffic. This is going back with a vengeance to the very early and primitive system of designing bridges, but it is hardly economical, or what would be expected of any one who knows or is thoroughly at home in the best and latest theory and practice of bridge-design and construction.

10. Evidently a difference should be made in fixing the load for a bridge in a thinly-settled and non-manufacturing country like Malabar, where the chances of a crowd-load of the dimensions quoted occurring are very remote, and the load for a "London bridge," where there is a constant and heavy traffic and the possibility of the maximum crowd loading occurring frequently. A bridge that is strong enough is just as good, and just as safe as one that is ten times stronger and even better; for in a large bridge, if we make it too strong we also make it too heavy. The weight of the structure itself has to be sustained, and this part of the load is a perpetual drag on the material.

11. The system of bridge flooring and bearings of the beams in small spans (30 feet and under), as shown in the type-drawings, instead of offering advantages, will only simply handicap the executive here with a most troublesome and costly class of work. Such roadway plates when exposed to the atmosphere and damp, if not frequently repainted or tarred, will rapidly corrode and have a short life. The outside may, and probably will, be looked after as it should be; but as regards the upper and hidden sides of the plates covered by the ballast, from past experience, it is well known among bridge men that due attention is not always paid to such points in practice. This is more particularly the case with works, the property of local bodies who have not, for very obvious reasons, the necessary skilled supervision required to do full justice in the matter of examining, repainting or repairing and protecting such works.

12. Then, again, as regards the bedding of the beams on the abutments and piers—for each opening under 30-feet span—the amount of work that will have to be done in getting the stones prepared to fit and receive the bed-plates and connections which, by the way, cannot be said to offer any real merits of simplicity or of practical utility, will be about twice as much as required to seat the ends of the trusses for an opening of 100 or 150 feet span. In fact, it is very much like using a 10-inch hawser to hold a mouse, and certainly makes one feel that the designer can never have faced the difficulties that beset the average up-country constructor. Besides, it offers no preponderating advantages in the way of making the bridge platform more secure, commensurate with the amount of trouble and cost that must result in getting this work done in out-of-the-way places.

13. In the system of flooring adopted by me throughout the district, we have a simple plank platform resting directly on the needle beams which, in the case of spans under 32 feet, are of course the main beams; the planking (6 inches × 3 inches) is placed 1″ apart nailed to spiking beams, bolted to the needle beams; and thus every bit of the platform can be thoroughly inspected. The system also offers great facilities for repairs as occasion requires; the condition of the materials can be judged with considerable certainty, and work can be inspected and carried out with ordinary local labor, such as can be obtained in any village in Southern India; and this too without interrupting the traffic in any way, whereas an iron floor would have probably to be renewed completely, and at one time causing long and serious delay and great inconvenience to traffic.

14. Then, as regards the bearing of the main beams, I have adopted the simple timber wall plate on all abutments and piers—a system that long and varied experience, not only of my own, but of many of the leading bridge men, has proved to be the most suitable in every way. It is a well-known fact that quick traffic over short spans causes vibration, and, in many cases, light abutments and piers have been shaken to pieces where light platforms or the small bearing plates on which they rest have been bolted down to, or merely rest on light bed-stones set on the edge of a 12-inch top course of pier masonry, and subjected to the action of fast and fairly heavy traffic. The timber bed-plate, however, acts as an elastic cushion, and takes up all or at least a considerable portion of the vibrations, thus preventing the masonry of the piers or abutments from being shaken to pieces or even distributed in any way. In addition to this advantage, we have the further benefit of a quick and easy means of bedding the beams, that is within the capacity of any ordinary village carpenter or even ordinary coolies, and thus entire freedom is ensured from all that heart-burning and anxiety—not to speak of greatly increased cost, that must result in most outlying districts from getting the troublesome, expensive and altogether quite unnecessary bed-stones, and further, the chance—not by any means imaginary—of getting bed-plates that are too small to receive the ends of beams or otherwise incomplete and unsuitable, and therefore requiring alteration before they can be placed in permanent position. I know of one case where stones either exactly similar, or closely resembling the stones required for type-drawing bed-plates, have been brought in from places over 100 and 130 miles distant, and besides, have taken some weeks to get them finished, as the local workmen could not be got to take up and complete the work satisfactorily. In connection with the same work, a number of bed-plates were misfits; and the whole of the work was thrown out and delayed very considerably, because of the difficulty experienced in getting a competent blacksmith to go down to do the work—trim one-eighth of an inch off the jaws of some of the said bed-plates. This although a little matter apparently, and one that could easily have been rectified in England, or in any large manufacturing town—at short notice and with very little trouble—took quite a time to complete. It is not the actual amount of work that troubles one, but the way these skilled laborers spin the work out, knowing as they do right well—all the trouble the Engineer had in getting them to go to such an outlandish place, and therefore acting on the knowledge that you will most likely not be able to get another man to take up the work just at the time he is most wanted, or even supposing he could be got, it is more than likely that the new man will follow on the lines of the old one; and as this fact is known and felt both by the workman and the Engineer, the former calmly takes advantage of the situation, while the latter has to look on—not calmly—and see things slide, while he feels utterly helpless to move and force or mend matters.

15. If the bridges referred to had been designed with simple heavy timber wall-plates, the work could have been finished on each span in a single morning instead of being dragged out for something like a week or two.

16. Another and most important point that must strike any "iron man" or Bridge Engineer is the two types of roadway adopted in these type-designs—

(*a*) the iron plates carrying a metal (broken stone) covering for all spans below 30 feet;
(*b*) the plank roadway for all spans above 40 feet.

17. There cannot be two opinions about having some uniform design for the flooring, as for other systems or parts of the bridges, and the simplest, if equally effective and cheap or cheaper, compared with the other and complicated design, was surely the one to be adopted.

18. From what I have already pointed out, it is quite clear that, under existing circumstances, the timber platform offers the greatest advantages in every way for such a district as Malabar, I think, and it is impossible to see just what grounds, if any, Mr. James has for adopting two flooring systems, unless it may be viewed in the light of an experiment.

19. When one has to face the many difficulties that constantly result from unskilled supervision and labor in the matter of erecting works—where fitting of any kind has to be done in outlying localities with nothing more effective than that feeble link in the chain of circumstances or forces that governs the construction and completion of all important works—the native artists or craftsman in stone, wood or metal, to rely upon, and when you have seen some important work brought completely to a stand, and hundreds and even thousands of rupees lost owing to the failure of this "link," then you realize to the full the urgent necessity for simplicity and uniformity of design.

20. Looking at the planking as now shown on the type-drawings for all spans over 40 feet and up to 152 feet, the effective span between bearings on cross-girders is seen to be 10 feet in spans below and 19 feet in spans above 80 feet. Now an elephant may cause an actual load of 4·4 tons (upon one forefoot) resting on three 6-inch planks or 1½ feet width of planking at centre of 10 or 19 feet spans, and the 4½ inches thick planking is certainly not sufficient to meet this requirement. I fancy there must be some error in the drawings, and that 4½ inches planking is really intended to be laid transversely to longitudinal axis of bridge and resting directly upon the needle or stringer (rolled iron) beams. If this is not intended, it is difficult to understand what the many tons of needle beams have been introduced for.

21. Considering—

(1) the finances of the district;
(2) the large number of waterways still to be bridged;
(3) the large number of existing bridges built prior to 1882 and not up to loads exceeding 2 to 2½ tons per axle;
(4) the light nature of the axle loads generally carried over our roads—country carts and pair of bullocks weighing 5,000 lb. or 2·5 tons approximately;
(5) the very small number of elephants to be considered;

I can only advise that the designs now submitted are quite out of place and unnecessarily heavy for a district like Malabar, and further that, if adopted, the Board will simply be sinking money to put up metal that will be lying inert for years; in fact, till time, and not work, has reduced the efficiency of the structure. It will also mean that before the remaining 48 important bridges are reconstructed according to the designs and estimates submitted by Secretary of State, the Board will be some *Rs. 3,29,000* unnecessarily out of pocket—*vide* comparative statement B.

22. If my designs are still to be adopted throughout this district, the total savings will be nearly *4½ lakhs* of rupees on Capital account as per statements A and B. The cost of repairs, allowing four renewals of wooden platform in 40 years and a wear of 1-inch per annum on the metal covering as per Mr. James' designs, shows a saving of Rs. 60,000 in 40 years in favor of the latter thus, leaving net saving in favor of my designs of nearly *4 lakhs* of rupees—see statement C, abstract of A and B.

23. As I was the means of calling for these type-designs (*vide* G.O., No. 269, of 1st February 1886, Public Works), I hope I will not be considered out of place in taking this opportunity of offering an opinion about them. I may mention that many of my suggestions as regards the designs for spans above 40 feet have been adopted by Mr. James in these type-designs.

24. As in the case of the tender for iron work for Iritti bridge, notified by the Secretary of State in his tender of 24th March 1886 (*vide* G.O., No. 1065, of 30th August 1886), and against which I protested in the Board's interests with, as we know, a clear saving of nearly *Rs. 26,000* resulting, so now must I advise against these type-designs being accepted, as the best or in any way suitable or necessary for a district like Malabar.

25. The accompanying statement D gives particulars of bridges and waterways of the district.

APPENDIX A.

No. 528.

NOTE *re* crowd and cart loadings for highway bridges.

(*a*) With reference to paras. 9 and 10 of my office note No. 527, dated 20th May 1889, I have to point out that a disorganized and packed crowd will average 150 lb. per man and may cause a load of 120 lb. per square foot of standing room.

(*b*) The annexed tables 1 and 2 show the approximate number of men required to cause loads of 120 and 80 lb. per square :—

Table No. 1.—Number of men required to cause a load of 120 per square foot of roadway.

One span.	9 FEET ROADWAY.	14 FEET ROADWAY.
	Number of people.	Number of people.
20 feet	144	224
30 ,,	216	336
40 ,,	288	448
50 ,,	432	672
80 ,,	576	896
100 ,,	720	1,110
150 ,,	1,080	1,660
200 ,,	1,440	2,220

Table No. 2.—Number of men required to cause a load of 80 lb. per square foot of roadway.

One span.	9 FEET ROADWAY.	14 FEET ROADWAY.
	Number of people.	Number of people.
20 feet	91	152
30 ,,	136	228
40 ,,	182	304
60 ,,	273	456
80 ,,	364	608
100 ,,	455	760
150 ,,	682	1,140
200 ,,	910	1,520

(*c*) The ordinary wheel loadings to be considered throughout the district are country carts with their loads and pair of draught bulls weighing on an average 2,300 lb. and occasionally rising to but never exceeding 5,500.

(*d*) Just how much chance there is of such crowds as come under 120 and 80 lb. per square foot as shown in tables 1 and 2, or again wheel loads heavier than the country cart occurring in any part of this district outside the limits of any of our large towns you can easily judge.

CALICUT,
20th May 1889.

(Signed) G. ANDERSON, M.I.C.E.,
District Engineer, District Board, Malabar.

No. 474.

Transferred to the Public Works Department.

(By order.)

FORT ST. GEORGE,
14th June 1889.

(Signed) W. S. MEYER,
Assistant Secretary.

To the Public Works Department.

ORDER—dated 20th July 1889, No. 1964 W., Public Works.

It is not incumbent upon any District Board to adopt the type-designs for iron bridges, which are intended merely to assist Engineers in the preparation of plans and estimates for such works. The loads provided for in the type-designs may possibly be met with in a few localities in the neighbourhood of large towns; but if these cases be allowed for, Mr. Anderson's designs will probably sufficiently provide for the ordinary requirements of Malabar. Copy of his note and of the President's letter will be forwarded to the Secretary of State in continuation of G.O., No. 1718 W., dated 28th June 1889.

(True Extract.)

(Signed) R. R. E. DRAKE-BROCKMAN, Lt.-Col., R.E.,
Ag. Joint Secy. to Govt., P.W.D.

To Superintending Engineers.
,, the Local and Municipal Department.

Exd. P. L. Pereira.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.
Govt. of {1889} Madras.
PUBLIC WORKS.

Dated July, 20th.

Recd. *Encl.*

G.O., 20th July 1889, No. 1964 W.

JULY.

Type-designs and Specifications for Bridges

Orders on letter from the President, District Board, Malabar, submitting remarks of the Board's Engineer on the — furnished by the Secretary of State for India.

3541

Extract from letter No 63/om of 26th February 1889 from the Superintending Engineer IV Circle to the President District Board South Canara.

× × × × × ×
× × × × × ×
× × × × × ×

4. While on the subject may I suggest the advisability of further diverting the stream and bringing it to the bridge in such a sweep as to do away with the skew thereof, as the effective waterway of the bridge is considerably reduced by the skew, or in other words you pay for useless increased span. Also I should say on reading the report the span might be safely reduced to about 35 ft. for

as

as there is a rocky bottom a slight heading up of the water and increased velocity in flood time could do no damage.

× × × × ×

(True Extract)

D. M. Campbell Col. R.E.
Superintending Engineer
21st November 1889 2 Circle

SM.

Encl 2
No 11199
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Extract from letter from the Local Fund Engineer, South Canara to the President District Board, South Canara, dated Mangalore, 3rd August 1889, No 102.

× × Referring to your endorsement No 402 of the 13th March last, on the Supg. Engineer's letter of the 26th February, No 63/M regarding the Adoor Bridge Scheme, I have the honor to return the plans, for that work in original, and in so doing to make the following remarks:-

× × × ×

3. Regarding the points mooted in para 4 of said letter I have to remark that though the effective water way of the proposed bridge is somewhat reduced by the skew of same, still the allowance is ample for the exigencies of the case. Again to further divert the stream's course and bring the bridge square, or nearly so would entail a considerable

amount

8

amount of earth work in cutting besides Compensation for land taken up and this would cost more than the slight increase in span the skew of the bridge as designed necessitates, besides the free discharge of the stream, would to a certain extent be thereby impeded.

× × × ×

(True Extract)

Signed / P. F. Fernandes
For President
District Board.

Encl 1
No 11199
89

(True Copy)

Alex Campbell Major R.E.,
21-11-89 Supg. Engineer, IV Circle.

AEt

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very urgent

3541

No 1825. South Canara District Board Office
Mangalore 11th November 1889.

1P

From

S. H. Wynne Esq.
President, District Board,
South Canara.

To

The Superintending Engineer,
Fourth Circle,
Coimbatore.

Sir,

1. Abstract of Iron work
1. Detailed Estimate
1. Abstract do
1. Specification
1 Report.
2 Plans.

I have the honor to resubmit herewith the plans and estimate for the Construction of an iron lattice girder bridge over the Adhoor stream on Road No 8 returned with your letter No $\frac{63}{M}$ dated the 26th February last, and to request that you will be so good as to submit it for the sanction of Government, as early as practicable.

2. As regards the advisability of diverting

diverting the stream as suggested in para 4 of your letter under reply, I have the honor to enclose an extract from the Local Fund Engineer's letter on the subject.

3. The iron work required for the bridge will be procured through local agency as under G.O. 20th July 1889, No 1964 W., it is not incumbent upon Local Boards to adopt the type designs for iron bridges.

4. The current year's budget provides an allotment for the bridge work and it is very desirable that it should be utilized before the close of the year. I have the honor therefore to request that you will be so good as to submit the estimate to Government as soon as possible for their early orders so that iron work may be finished and received from England before the next monsoon.

I have &ca.

Signed/ P. F. Fernandes.

For President.

No $\frac{520}{E.W}$

Copy forwarded to the Chief Engineer Public

Encl. 9
2 copies of extracts
1 Abstract of iron work.
1 Estimate
1 Abstract

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1 Specifn
1 Report
2 Plans
9

Public Works Department for early sanction of Government.

2. An extract (para 4) from this office letter No 63 M of 26th February 1889 to the President District Board and the Local Fund Engineers observations thereon are herewith forwarded for the information of the Chief Engineer.

3. The undersigned sees no objection to the design and estimate and recommends that Government will be pleased to accord their sanction to the work as soon as possible to enable the Local Fund Board to utilise the grant for the same in the current year's budget before the end of March next.

D. McN. Campbell Major R.E.,
Superintending Engineer, IV Circle.

Coimbatore
21st November 1889.

[illegible] 11/89

From

The Supg. Engr.
4th Circle

No. 1964 W a/ 20-7-89

Q. 1964 W a/ 20-7-89

Dated 21st } Novr/89
Despd 22d }

Recd 23. 11. 89

No. 520/E.W.

Enclo. 9 (+2 plans)

Construction of an iron lattice girder bridge over the Adhoor stream Road

Forwarding copy of letter from the President Dt. Board South Canara re-submitting plans & estimate for the — do.

3541 P.W.D.

3 Pl.

Note by the Chief Engineer, General Buildings and Roads Branch.

The question regarding the "skew" of the proposed bridge has already been discussed by the Supdg. Engineer IV Circle and the District Board, and the balance of the argument is in favor of a "skew" bridge.

From the survey plan it is apparent, that the proposed training of the river will involve much more expense than is contemplated. The estimate only provides for two short lengths (30') of revetment on the up-stream side of the bridge. A similar protection ought also to be afforded for the down-stream side. The details of the girders

and

113

and iron work are satisfactory, and the price Rs 350 a ton should ensure good material & workmanship ~~liberal~~. The rate for concrete Rs 50 per 100 c.ft. appears to be much too high. With these remarks the estimate is submitted for the sanction of Government.

4.12.89

4.12.89
E.W.

3541
9-12-89

Public Works Department.

C.S. & Hy
4.xii

Current No. 11,199
Letter No. 520 E.W.
Dated 21st November 1889
From the Supdg: Engr. II Circle

Sanction
29-11-89

NOTE OF REMARKS.

The Est: under review amounting to Rs 7,000 provides for constructing an iron lattice bridge in the 19th mile of Road No 8 from Cassergode to Julsore in the Cassergode Taluq South Canara Dist:-

The necessity for the bridge, as explained in the report, is to connect the interior of the Dist:; Coorg & Mysore with the Coast line -

The bridge is to have a skew of 4'-8" or thereabouts and the span will be 41'.6". The drainage area of the channel is approximately

12

about 6 Sq: miles and the waterway provided in the bridge is 572.5 Sq feet & It is stated that during the heaviest rains the water in the Channel has not been known to rise higher 12½ ft above bed level which allows 2½ ft for floating bodies to pass under the bridge –

The abutments of the bridge are to be of Masonry laid on Concrete, the foundations will be carried down to a depth of 8 feet into firm Clay but where solid rock is met with it will be founded on rock

The bridge is calculated to stand a distributed load of 65 tons, made up as follows 35

	Tons
Weight of Iron work —	12.0
— do — Metal Roadway —	15.5
Live load at 120 lbs per Sq. ft —	36.0
Total Tons	64.5

or say 65 tons which will be carried on two girders 46'-6" in length of the required section with the cross girders &c –

As the width of the roadway is to be 15' it must be safer to have a centre girder making in all three principal girders –

This would involve fresh designs for the entire bridge on the proposed load & cross Girders would be unnecessarily heavy

The up stream side of the banks are to be revetted to a distance of 30 ft from the bridge on each side –

3

There is a marked difference in

rate quoted for concrete in the Est: and that allowed in the Schedule viz Rs 50 per 100 cft in the Est: against Rs 13-8-- in the Schedule —

The other rates are fair —

The plans & Est: have been counter-signed by the President of the Dist: Board —

26/11/89

It will be seen by the Est: that the revetments are 4 — 30 feet in length, 5' in breadth and 4 feet in depth, the depth seems too great —

26/11

This sh.d be pointed out.

No provision made for training the river, apparently ~~[illegible]~~ this is contemplated, vide survey sheet.

11. 199.

W

3541 W

3541

The question regarding the "skew" of the proposed bridge, has been discussed by S.E. IV and the District Board, & the balance of the argument is, in my opinion in favor of a skew bridge —

From the Survey plan, I would say that the proposed training of the river, would involve much more expense than is contemplated; the estimate only provides for two short lengths (30') of revetment, on the up stream side of the bridge. X

[illegible] 29.11.8

The details of the girders & iron work, are satisfactory, and the price 350 Rs a ton is liberal.

The rate for concrete 50 Rs appears to be much too high.

29.11.89

14

No. 3541 W

Building [illegible]
Civil Dept.

rate quoted for

26
41

3541 No. 3541/W

Building [illegible]
Civil [illegible]

4P PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

12th December
1889

READ the following

From the Superintending Engineer IV Circle. — No. 520 Wdy 21st Novr 1889.

Note by the Chief Engineer P. W. Dept — dated December 4, 1889

The estimate amounting to Rs 7,000 for constructing an iron lattice girder bridge over the Adhoor Stream on road No. 8 from Kasaragod to Jalsoor, in the South Canara District, is sanctioned.

2. Attention is drawn to the Note by the Chief Engineer P. W. D. above recorded.

3. This sanction has been registered as Local No. 31 W of 1889–90.

HES
11 Dec

Desp
2/1/90

To
The S. E. IV Circle. S
Local & Municipal Dept
with 7 enclosures.

HCB
4. 12. 89

To
(The Hon'ble the Chief Secy to Govt for favor of counter-initials)

Recd
4-12-89

CN

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3541

CHIEF SECRETARY
15 DEC 89
GOVERNMENT OF MADRAS

Circ
12-12-89

C.S. 4 XII 89
H.W. 9-12-89
R 12-12-89

(21)

16

11199.

Govt. of Madras.

PUBLIC WORKS.

Press

14/10/89

Dated

Recd.

Encl.

G.O. 12 Decr 1889 No. 3541 W.

Bridge over the
Adhoor stream
South Canara District

Estimate amounting
to Rs 7,000. for constg:
an iron lattice girder
~~bridge over~~ —.
on Road No 8 from
Kasaragod to Jalsoor
Sanctioned

30/3

(16)

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EEC 18/12.