(1) பக்கங்களின் எண்ணிக்கை 64

(2) புதுக்கித் திருப்பிய நாள் 1/8/89

(3) ஆதாரங்குறிப்பவர் சுருக்கொப்பம்

தமிழ்நாடு ஆவணக் காப்பகம்.

தமிழ்நாடு அரசு

நிருவாகச் சீர்திருத்தத் துறை

அரசாணை எண்.
மு. கோப்புத் தாள் எண். 2069

அச்சகம்
பலவகை

நாள் : 1—8—1989

198 .

மடிக்கவோ கண்டபடி கையாளவோ கூடாது

ஆணை. எண்-1—18,006—15=8=89.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following paper:—

Despatch from the Right Honorable Lord CROSS, Her Majesty's Secretary of State for India, to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 20th June 1889, No. 1, Public Works (Stores).

With reference to my despatch in this department, No. 2, dated 12th April 1889, regarding the supply of type designs for road bridges, I forward, for your Lordship's information, a copy of a report * by the Consulting Engineer to this office, recommending that a new series of designs be prepared for riveted bridges for 40 feet, 50 feet, 60 feet, 70 feet and 80 feet spans.

* Dated 1st May 1889.

2. The three indents referred to in the report as having been received for bridge work in accordance with the existing type designs, are quoted in the margin. In each of these cases the Consulting Engineer suggested that plate girder riveted bridges would be cheaper and better than the pinned trusses shown in the type designs; and, on further reference being made to indenting officers, they eventually agreed to the Consulting Engineer's suggestions.

Indent for Gadilam bridge, South Arcot, forwarded with letter from the Secretary to the Government of Madras in the Public Works Department, No. 3132, of 6th October 1888.

Indent for a bridge in Berar, forwarded with letter from the Secretary to the Resident, Hyderabad, Public Works Department, No. 54 G.A., of 13th February 1889.

Indent for the Talavasal bridge, forwarded with letter from the Secretary to the Government of Madras in the Public Works Department, No. 500 W., of 19th February 1889.

3. It does not appear desirable that Engineers in India should be too rigidly bound to indent for bridge work in accordance with the existing designs, and it is thought that, with the assistance of the proposed new designs, they will be in a better position to decide what kind of bridge is most suitable for their several requirements. With this view, instructions have been given for the preparation of the designs, and I request that I may be informed how many lithographed copies will be required.

Enclosure.

Report by Consulting Engineer, dated 1st May 1889.

Many of the type drawings seem more suited to special and therefore rare cases than to ordinary and therefore common cases. We have now had indents for three road bridges in which simple plate girders riveted up were evidently cheaper and better than the pinned trusses shown on the types, and which have been preferred to the types by the authorities in India when their attention has been called to the matter. Moreover, all the types above the span of 30 feet provide timber floorings, whereas India evidently, and I think rightly, prefers iron floorings in all ordinary cases.

The type designs show rolled girders with corrugated iron floorings bolted to them up to 30-feet span. For larger spans, the types show what they call pony trusses pinned together and with timber floorings, the object in all the designs being apparently to avoid riveting and to diminish the quantity of ironwork as much as possible, even at the cost of using a great deal of timber, which is quite as expensive in India as iron. Now riveting presents difficulties in very few parts of India, and is better than pins where possible, and metalled roads are better than timber roads, and though requiring heavier main girders are usually cheaper as well as more durable. I would therefore recommend that we add to the type drawings a new series, consisting of plate girders for 40-feet, 50-feet, and 60-feet spans riveted up, and floored with corrugated iron riveted to the main girders, and carrying a metalled roadway; and, as there is no difficulty as a rule in placing the main girders of a road bridge under the roadway in spans up to 60 feet, I should so place them in these cases. I would also propose to add new types for 70 and 80 feet girders, in which the main girders would be of the lattice or truss description riveted together, with corrugated iron floorings riveted to them, resting on cross girders and carrying a metalled roadway. In these cases, the roadway would be laid between the main girders and rest on their bottom flanges. Timber would thus be wholly absent, except as curbs to keep carts off the handrails, in all the types up 80 feet.

In respect to width the type drawings show for all the sizes I am dealing with a width of 14 feet in the clear. In two of the three cases I have had to deal with this width has been asked for, but I suspect only because it was the width of the type. In the third case the width asked for was 18 feet, and I have a case before me, where the type drawings are not referred to, in which a width of 9 feet is asked for.

I would suggest that the new types be prepared for two widths, 12 feet and 18 feet. The same main girders might be used for anything less than 12 feet, and up to 14 feet, and probably 18 feet is the greatest width ever likely to be wanted.

I cannot well estimate the cost of the new types, but the drawings would be prepared in my office at times when the work in it is slack, and the real extra expenditure caused by them would not be large, not more than 150*l*.

Order—dated 1st August 1889, No. 2069 W., Public Works.

Ordered that the following reply be sent.

(True Extract.)

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

Exd. P. L. Pereira.
Spare Copies

2068
2

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated August, 1*st*.

Recd. *Encl.*

G.O., 1st Aug. 1889, No. 2069 W.

AUGUST.

Bridges

Ordered that the Secretary of State for India be addressed in reply to his Lordship's despatch forwarding report by Sir A. Rendel recommending that a new series of designs be prepared for riveted — for 40, 50, 60, 70 and 80 feet spans.

205/3

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers :—

From C. A. GALTON, Esq., President of the Local Fund Board, Malabar, to the Chief Engineer, Public Works Department, dated Calicut, 18th April 1884, No. 105—Through the Superintending Engineer, IV Circle :—

I have the honor to submit, herewith, the plans and estimates (according to the list annexed) for the iron-girder bridges which it is proposed to erect over the Iritty and Merumpoya rivers at the 27th and 13th miles, respectively, on the trunk road from Tellicherry to Coorg. This road is one of the most important lines of communication in the district, and carries a very heavy traffic during the coffee season. It is estimated that from four to five hundred carts pass along the road daily at this time of the year, and the absence of bridges over these rivers causes very great hindrance to the traffic. It is desirable, therefore, that sanction be obtained at the earliest possible date to admit of the materials being landed as soon as the next monsoon is over, in which case the bridges might be erected before the rainy season of 1885. Copy of the Local Fund Board's resolution passed at their meeting held on the 16th instant is submitted herewith.

2. As the Local Fund Engineer, Mr. Anderson, has dealt very fully with the circumstances of each case in his general reports accompanying the estimates, it is unnecessary for me to go over the same ground, and a few words of explanation will suffice.

3. The Iritty river probably presents greater difficulties than any other river in the district owing to its great breadth, depth, the rapidity of its current and the unhealthy nature of the locality. The amount of the present estimate is Rs. 78,000, and provides for an iron superstructure on the Whipple-Murphy single trellis system. The reasons for adopting this system in preference to others are fully explained in the report. It is proposed to have seven spans of 72 feet each, and the roadway will be 14 feet broad. The previous history of this bridge is given in Mr. Anderson's report, but the dates of construction of the original bridge, of its destruction and of its restoration cannot be ascertained. The records are possibly in the Public Works Department. No papers bearing on the subject have been discovered in the records of the Local Fund department. In 1878 the second superstructure was dismantled as it was in an advanced stage of decay ; in the following year an estimate, amounting to Rs. 63,330, for a Warren girder bridge was sanctioned (*vide* G.O., dated 21st April 1879, No. 1190 W.) but further inquiry showed that alteration was required and a revised estimate, amounting to Rs. 47,700, was submitted for sanction (*vide* Board's proceedings, dated 5th August 1882, Mis. No. 5900). It does not appear that sanction was ever accorded.

4. Owing to the occurrence of very heavy floods in 1882, a re-investigation of the waterway was deemed desirable, and the searching inquiries which have been instituted by the Local Fund Engineer show that provision must be made for a much heavier flood-discharge than was considered necessary when the former estimates were prepared. This accounts for the increase in the estimate. The investigation has been very thorough, and Mr. Anderson has visited the locality time after time to ensure the accuracy of his calculations, which are clearly set forth in the papers. I am sure they may be accepted with confidence. As to the designs it will be patent that very great care and labor have been bestowed upon them, and Mr. Anderson's

thorough knowledge of this branch of his profession is a guarantee that his designs are the best suited for such a work as that under consideration.

The specifications contain very full instructions explanatory of the designs and there will, I imagine, be no difficulty in supplying materials with such detailed information as to what is required.

5. The old Merumpoya bridge was destroyed by a high flood in 1882. This is a comparatively small river, but it runs between lofty banks and provision has to be made for a much greater flood-discharge than was allowed for by the former structure. It is proposed to have three spans of 72 feet and the width of the roadway will be 14 feet. Owing to the nature of the bottom it will be necessary to construct wells, which involves extra expenditure on account of plant, &c., and the piers cannot be utilised as in the case of the Iritty bridge, where five piers are standing and in good condition; consequently the cost of this bridge is higher than that of the Iritty bridge in proportion to its length. The fullest information regarding the proposed structure is afforded in the report and accompanying papers, and it is unnecessary to enter into greater detail.

6. As regards the method of obtaining the materials, I think it will lead to economy and expedition if the Local Fund Board are permitted to procure them by private contract instead of through the store department of the India Office. When the original estimate for Rs. 63,330 was sanctioned there was some idea of procuring the materials through Mr. Maylor, of Messrs. Peirce, Leslie and Company, and perhaps some firm here or in Bombay may be willing to tender for the supply of the iron work. An alternative plan would be to employ a qualified Consulting Engineer, like Mr. G. B. Bruce of Westminster, who, I understand, has had large experience in the supply of iron girder bridges for Indian railways, to procure the materials in the cheapest market and pass them before despatch. His charges would probably add some £100 to the estimate, but as Mr. Anderson's rates are based on the highest quotations of recent date, it is probable that there will be savings on the iron work and, in any case, it will be worthwhile to pay a little more to ensure prompt delivery of the materials to admit of the erection of the bridges with the least possible delay. Even if the contract be given to a local firm, it will be necessary to employ an experienced engineer at Home to inspect and pass the materials to ensure their being in accordance with the specification, and properly tested. Owing to the very unhealthy and inaccessible nature of the locality it is not likely that any firm will undertake to *erect* the bridges by contract, and the Local Fund Board must make their own arrangements The estimates provide for a special staff for the purpose and a standing camp, as labor will have to be brought from a distance. It will be necessary also to provide medical aid. Mr. Anderson will himself direct operations, but his other duties will not admit of his devoting his whole time to the work, and a qualified Assistant Engineer must be entertained during the erection of the two bridges.

7. The excess over the budget provision can be met from the allotments for other new works. The total grant is Rs. 1,67,000, but it is impossible to undertake all the works which have been entered in the budget and several must be deferred for some time to come.

From Colonel J. BEATTY, R.E., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 1st May 1884, No. 210 E.W.

I have the honor to forward, herewith, a letter from the President, Local Fund Board, Malabar district, accompanied by plans, estimates, &c., prepared by the Local Fund Engineer, Mr. Anderson, for two bridges which it is proposed to erect on the Iritty and Merumpoya rivers at the 27th and 13th miles of the trunk road from Tellicherry to Coorg.

1 Original letter, No. 105, of 18th April 1884, from the President, Local Fund Board, Malabar.
2 Lists showing 80 enclosures of plans, estimates, &c., sent by banghy parcel.

2015/4

2. The Iritty bridge, which is estimated to cost Rs. 78,000, is to take the place of one which consisted of four spans of 70 feet and two end spans of 15 feet, with masonry piers and abutments founded on rock and a superstructure of teak, which was so decayed in 1878 that it had to be pulled down.

3. The old masonry is to be utilised as far as possible, one new pier and two new abutments being required, and the proposed bridge is to consist of seven openings of 72 feet each, spanned by iron pony trusses on the Whipple-Murphy single trellis system, each 72 feet in clear and 76 feet effective, bearing a 14-feet roadway of wrought-iron plate cross-girders, stringer beams and timber platform. The special feature of the main girders is the connections by means of steel pins of $3\frac{3}{4}$ inch diameter, to which the designer, no doubt, justly attaches importance as greatly preferable to the ordinary system of rivetted connections.

4. The piers are 12 feet thick at bottom, 7 feet at top, and 22 feet long, exclusive of semi-circular cutwaters. M.F.L. is assumed to be 54·72 feet above the deep bed of the river, and there is to be a clear headway of 3 feet between that line and the underside of the cross-girders, so that the roadway will be about 59 feet above the deep bed.

5. The water-way provides for "a discharge of 250,000 cubic feet per second; due to 90 per cent. of an 18-inch down-pour" flowing off the catchment basin "in addition to the ordinary monsoon discharge of 80,000 cubic feet."

6. The Merumpoya bridge is to take the place of one of masonry, three spans of 36 feet, which was totally destroyed by a high flood on the 13th July 1882, and an entirely new structure is required.

7. The new Merumpoya bridge, which is estimated to cost Rs. 49,000, is to have three openings of 72 feet each, spanned by iron trusses and roadway exactly similar to those of the Iritty bridge.

8. The piers and abutments are to be carried up to a height of 30 feet above the deep bed so as to give a clear headway of 3 feet above M.F.L. The two piers, which are 6 feet thick, are to rest on wells sunk to 18 feet below the deep bed of the river at site; and the foundations of abutments are to be carried down through and rest on a bed of detrital laterite at 11 feet below the proposed new slope of river-bed and bank.

9. The proposed waterway provides for "a discharge of 47,000 cubic feet per second; due to 90 per cent. of an 18-inch down-pour, in addition to the ordinary monsoon flood-discharge of 10,500 cubic feet due to downpours of 3 to 5 inches lasting for three or four days."

10. The estimates have evidently been prepared with the greatest care by Mr. Anderson, and the papers sent give full information regarding the designs and method of construction, as well as reasons for the amount of waterway proposed, details of the rates, &c., and I see no reason to question the correctness of his figures or the suitability of his designs.

11. The estimates have apparently been submitted under one covering letter because it is proposed to carry them out at the same time by means of a special temporary establishment, which has been provided for, and because it is proposed to order from England at one time the iron work of the ten spans of 72 feet.

12. It will be observed that the Local Fund Board desire the earliest possible sanction in order that materials may be prepared and the works carried out without delay; funds being available in the budget of the present year.

13. In the examination of the estimates in this office no mistakes of any importance have been discovered.

Note by the Chief Engineer, Public Works Department.

These projects provide for bridges over two large streams, the Iritty and the Merumpoya, on the main line of road leading from Tellicherry to Coorg. The designs

and estimates have evidently been prepared with unusual care, and are worked out in elaborate detail.

2. The Iritty bridge is designed with seven openings of 72 feet each in the clear, to be spanned by iron girders of the Whipple-Murphy type. The old bridge had four openings of 70 feet and two of 15 feet.

3. The Merumpoya bridge is designed with three openings of 72 feet each, spanned by girders similar in all respects to those proposed for the Iritty bridge. The old bridge had three openings of 36 feet.

4. The reasons for this large increase of waterway are stated by Mr. Anderson in his reports, and have been more fully explained to me in person. I am satisfied as to the accuracy of his calculations.

5. Since the estimates reached me, Mr. Anderson has slightly altered one of the formulæ for calculating the dimensions of the iron work, with the result that the weight of each complete 72-feet girder is reduced from 21·17 tons to 19·93 tons. He has thus been able to reduce the cost of the Iritty bridge from Rs. 78,000 to Rs. 76,600, and the cost of the Merumpoya bridge from Rs. 49,000 to Rs. 48,000.

6. These alterations have my full concurrence, and the estimates are recommended for sanction.

OOTACAMUND,
27th May 1884.

(Signed) J. SHAW-STEWART, Col., R.E.,
Chief Engineer, P.W.D.

ORDER—dated 2nd JUNE 1884, No. 1373 W., Public Works.

The estimates as shown below are sanctioned for execution by the Malabar Local Fund Board :—

		Rs.
Bridge over the Iritty river	... ...	76,600
Do. do. Merumpoya river	... ...	48,000

2. This sanction has been registered as Local No. 10 W. of 1884-85, and classified as Communications, Original Works.

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, IV Circle.
" Board of Revenue, with eighty-two enclosures.
" Financial Department.

Exd. E. Fernandez.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1884} Madras.

PUBLIC WORKS.

Dated June, 2nd.

Recd. *Encl.*

G.O., 2nd June 1884, No. 1373 W.

JUNE.

Bridges

Estimates, amounting to Rs. 1,24,600, *for constructing* — over the Iritty and the Merumpoya rivers, Malabar district, sanctioned for execution by the Local Fund Board.

2065/b

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads,
Civil Works.

Read—the following papers :—

From W. LOGAN, Esq., President of the District Board, Malabar, to the Under Secretary to Government, Public Works Department, dated Vaniamkulam, 21st August 1885, No. B.

I have the honor to reply to your official memorandum, No. 194, dated 9th ultimo, on the subject of changes to be introduced into the Local Fund rules regarding the control over Local Fund public works by your department, and calling for a report on the number and kind of estimates which were, in 1884-85, sent to your department for scrutiny and sanction, and on the nature of the changes made in the estimates.

2. No. 23 of the Draft Local Fund Public Works Code directs that, in the case of important projects, involving scientific points or other considerations of special character, the report accompanying the estimate shall give a full account of the basis on which every part of it has been framed, the various considerations that have guided the designer in questions of engineering details, economy of construction, and the utility or practical working of the project when carried out.

3. I have delayed replying to your memorandum sooner because it seems to me that this rule should be modified to this extent, namely, that, when the project submitted for sanction is founded on standard designs, standard estimates, and standard specifications, this report may be dispensed with except where the standards have been departed from.

4. In the enclosed list of estimates for works submitted to your department for sanction and scrutiny in 1884-85, the two most important items are the Iritti and Meerumpoya iron bridges. The preparation of the plans, estimates and specifications for these works took up much of the valuable time of our District Engineer—more of it than could rightly be spared for such work. The plans, &c., were passed without any changes being made in your department, but when submitted to the authorities at the India Office, they proposed to change not only the design, but the materials of which the structures were to be manufactured. It is with a view to avoid the necessity for such changes in future that I now address you at considerable length.

5. It is obvious that if we had standard designs, estimates, and specifications for such works, not only would the valuable time of our District Engineer be saved, but there would be great facility in passing the projects through your department, and still greater facility in supplying the structures from England at the most economical rates.

6. It has been definitely ruled that iron work of this description, if obtained from England, is to be obtained by indent to be sent through the India Office.

7. My District Board has still some hundreds of bridges with wooden superstructures which we wish gradually to replace by more durable structures of iron, and when these are finished, and we can apply our surplus funds to the opening up of new roads, we shall have hundreds more of such works for construction, so that the question, in respect to this District Board, is a large and very important one.

8. After consulting our District Engineer, I requested him to take this opportunity of bringing the matter forward with a view, if possible, to combined action on the part of all the District Boards of the presidency.

9. Mr. Anderson, on whose qualifications for the task thorough reliance may be placed, has, accordingly, in the accompanying papers, prepared detailed instructions for the preparation of standard designs, estimates, and specifications of bridge superstructures for spans rising from 5 feet to 152 feet effective, and of piers rising from 15 feet to 50 feet.

10. He estimates that these standard designs, &c., would cost about Rs. 12,000, and he proposes that the originals should remain at the India Office, and that copies of them should be supplied to all the District Boards of the presidency as well as to your department.

11. The value of combination in this matter is sufficiently evident from the facts stated in paragraph 12 of Mr. Anderson's office note. Each District Board would (if *combination is resorted to*) obtain for about the same money which it now costs to get drawings, specifications, and estimates *for one bridge*, standard designs, &c., for no less than *twenty-one* such superstructures and *eight* bridge piers.

12. The fact that all the Railway Companies have combined in this matter (paragraph 15 of Mr. Anderson's note) is, I submit, a very strong reason why our District Boards should similarly combine for the same ends.

13. I solicit your earnest attention to paragraphs 16 to 18 of Mr. Anderson's note in regard to the facilities which the supply of such standard designs, &c., will afford to District Engineers for rapidly and economically estimating for such works.

14. In paragraphs 19 to 23 and in paragraph 30 of the note, Mr. Anderson explains the advantages of the pin system of construction in preference to the rivetting system. My District Board fully discussed this question before submitting the estimates for the Iritti and Meerumpoya bridges, and the decision was unanimous in favor of the system recommended by Mr. Anderson, for the very substantial reasons which you will find set forth in detail. Several of our rivetted bridges erected in the Wynaad some years ago are now sagged and out of shape, and rivets are constantly being found loose.

15. In paragraph 24 will be found reasons for preferring an open section for the posts, struts, and braces. The reasons adduced for this proposal are of a self-evident character and require no further remarks from me.

16. In paragraph 25 of the note and in paragraph 30 of appendix A, Mr. Anderson assigns reason for fixing the panel lengths of the standard trusses at 11 feet for spans between 33 feet and 88 feet. These trusses will, therefore, be built up of 3, 4, 5, 6, 7 and 8 panels, respectively, each panel being 11 feet long. For spans over 88 feet the panel lengths are to equal the depths of the trusses, *i.e.*, one-eighth of the spans, and the trusses will consequently be built up of 8 panels of the respective lengths of 12 feet, 13 feet, 16 feet, and 19 feet. On these points you will be a better judge than I am of the soundness of Mr. Anderson's proposals, but I may add that it seems to me that his conclusions have been very carefully worked out, and I am prepared to advise my District Board to adopt them.

17. In paragraphs 26 to 29, Mr. Anderson deals with the question of materials to be employed, wrought-iron *versus* steel, and I consider he has shown ample reasons for preferring the former.

18. In the papers accompanying Mr. Anderson's note full details are given of what is wanted in this matter, and, if approved by your department and the various District Boards, the order might go home to the India Office at an early date and be placed in the hands of Mr. Batho, the Consulting Engineer named in General Hyde's memorandum printed in G.O., No. 183 L.F., Financial, dated 19th May 1885.

19. If the combined action of all the District Boards with your department herein recommended in regard to iron bridges is adopted, then, I think, the rules in paragraphs 18 to 28 of the Draft Local Fund Public Works Code may be amended considerably in order to save the District Board engineering establishments much time and labor in the preparation of estimates for such works.

No. 395, Financial.

Referred to the Public Works Department for favor of opinion.

(By Order.)

Madras,
9th October 1885.

(Signed) M. HAMMICK,
Assistant Secretary.

2685/7

Note by the Chief Engineer, Public Works Department.

Mr. Anderson, M.I.C.E., Local Fund Engineer, Malabar, proposes that complete sets of type drawings, specifications, and estimates for iron bridges for spans from 5 feet to 152 feet, with width of roadway of either 14 feet or 9 feet clear, be prepared in England by a competent Engineer; one copy of each complete set to be retained in the India Office Store Department, one copy to be filed in the Chief Engineer's office, and one copy to be in the charge of each of the Local Fund Board Engineers in the presidency.

2. The advantages claimed for the proposal are—

(1) Time will be saved by having designs ready at hand, instead of having to get them prepared by officers who are little used to such work.
(2) The designs, being prepared by specialists, will be better and more satisfactory.
(3) Time will be saved, as it will be unnecessary to have the designs checked by the Public Works Department.
(4) Orders on the India Store Department will be more quickly disposed of.
(5) The most economic span will be arrived at quickly and correctly.

3. The spans proposed for the bridges for which type designs are to be prepared are from 5 feet clear to 152 feet effective. From 5 feet to 30 feet clear spans, it is proposed to use plate girders or rolled beams, and the designs are to increase in span by increments of $2\frac{1}{2}$ feet. From 33 feet up to 152 feet effective spans, the designs are to be for lattice girders increasing by increments of 11 feet. The total number of spans for which designs would be required is therefore twenty-one.

4. The Chief Engineer approves Mr. Anderson's proposals respecting type drawings of bridges, &c., and for the two widths of roadway named by him, viz., 14 feet and 9 feet.

5. Mr. Anderson further proposes to have standard designs for open trestle and screw-pile piers from 15 feet in height, increasing by 5 feet each design up to 50 feet. Eight designs would thus be required. The Chief Engineer is, however, of opinion that there are few cases in which bridges on piles would be required, and that as a rule it would be cheaper and better to build masonry piers. This portion of the proposals should therefore be omitted.

6. As calculated by Mr. Anderson, the total initial cost of the preparation and typing the designs would be Rs. 12,000, but that figure is probably in excess of what will be required; and the omission of the designs for screw-pile piers will reduce the cost considerably.

7. Whatever the total cost may be, Mr. Anderson proposes to divide it equally amongst the Local Fund Boards; and even if the cost reaches Rs. 12,000, the share to be paid by each Board would amount to only about Rs. 500, for which sum they will receive a complete set of designs; whilst the compilation of a design by their own Engineer for a single bridge would probably cost as much. There can be no doubt that the standard designs would be most useful, not only to the Local Fund Boards, but also to the Public Works Department; and the Chief Engineer is of opinion that the Public Works Department might fairly bear one-half of the cost of the designs, the remainder being paid by the various Local Fund Boards.

8. Apparently, the first step to be taken is to forward the documents submitted by Mr. Anderson to an Engineer, whose speciality is iron bridges, for his opinion and suggestions; on receipt of which, steps should be taken to obtain an estimate of the cost of preparing the designs, &c.

9. In conclusion, the Chief Engineer desires to note that Mr. Anderson has gone most carefully and fully into the subject, and has prepared most excellent instructions for the preparation of the designs.

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Chief Engineer, P.W.D.

15th December 1885.

Memo. from the Secy. to Govt., Public Works Dept., dated 15th Dec. 1885, No. 2163 C.
Office note from the Chief Secretary, dated 11th January 1886.
Memo. from the Secy. to Govt., Public Works Dept., dated 16th Jan. 1886, No. 216 C.

Order—dated 1st February 1886, No. 269 W., Public Works.

Ordered that the following letter be addressed to the Secretary of State for India, to whom the documents submitted by Mr. Anderson will be forwarded in original.

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintending Engineer, Tank Maintenance Scheme.
" Financial (L.F.) Department, with copy of despatch to Secretary of State.
" Superintending Engineers, for information.
" Examiner, Public Works Accounts.

Exd. E. Fernandez
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of [1886] Madras.

PUBLIC WORKS.

Dated February, 1st.

Read. *Encl.*

G.O., 1st Feb. 1886, No. 269 W.

FEBRUARY.

Type Designs for Bridge Superstructure

Orders on proposal made by the President, District Board, Malabar, for the preparation of —.

PUBLIC WORKS SECRETARIAT MADRAS

2565/9

PUBLIC WORKS DEPARTMENT.

Letter—to

The Right Honorable the SECRETARY of STATE for INDIA.

My Lord,

We have the honor to forward, for your Lordship's information, copy of our proceedings marginally noted, relative to a proposal made by the President of the District Board, Malabar, that type designs be prepared for bridge superstructures in view to saving the valuable time of Engineers, which is at present taken up in preparing a separate plan, specification, and estimate for each bridge to be constructed.

No. 269 W., dated 1st February 1886.

2. Mr. Anderson, the District Board's Engineer in Malabar, has submitted detailed instructions for the preparation of the proposed type designs and estimates; and these documents are forwarded, herewith, in original. Mr. Anderson proposes that complete sets of type drawings, specifications, and estimates for iron bridges for spans from 5 feet to 152 feet, with width of roadway of either 14 or 9 feet clear, should be prepared in England by a competent Engineer.

3. The advantages claimed for the proposal are set forth in the note by the Chief Engineer, Public Works Department, which is printed in our proceedings herewith forwarded. We agree with the remarks made by the Chief Engineer; and we consider that the proposal to have standard designs for open trestle and screw-pile piers may, for the reasons assigned, be omitted from the scheme.

4. The proposed type designs will be of great use, not only to Local Fund Boards, but also to the Public Works Department, and we recommend that the correspondence and documents be submitted, in the first instance, to an Engineer whose speciality is iron bridges, for his opinion and suggestions; and, on receipt thereof, that the necessary steps be taken in view to the preparation of estimates of the cost of the proposed type designs.

We have the honor to be,

My Lord,

Your Lordship's most obedient, humble servants,

(Signed) M. E. GRANT DUFF.
(„) H. E. SULLIVAN.
(„) C. G. MASTER.

Fort St. George,
1st February 1886.

Exd. E. Fernandez.

GOVT. OF MADRAS.

PUBLIC WORKS DEPARTMENT.

LETTER to the Right Honorable the Secretary of State for India.

No. $\frac{2}{269}$ W., dated 1st Feb. 1886.

Forwarding correspondence relative to a proposal made by the President, District Board, Malabar, for the preparation of type designs for bridge superstructure, and recommending that the subject be referred to an Engineer in England for opinion and suggestions.

PUBLIC WORKS SECRETARIAT MADRAS

2069 11

16TH JUNE 1886, No. 1525 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following despatch from the Right Hon'ble the EARL OF KIMBERLEY, Her Majesty's Secretary of State for India, to His Excellency the Right Hon'ble the Governor in Council, Fort St. George, dated India Office, London, 20th May 1886, No. 2 (Public Works):—

With reference to your Excellency's Public Works letter, No. 2, of the 1st February 1886, recommending that type designs be prepared for bridge superstructures in order that the time of the engineers may be saved, I have to inform you that, in accordance with the recommendation of my professional advisers, I have authorised the preparation of designs and estimates for bridges rising from 5 feet to 25 feet by increments of 5 feet, from 33 feet to 66 feet by increments of 11 feet, and from 66 feet upwards by increments of 22 feet. This will give 13 types, instead of 21 proposed by Mr. Anderson, the District Board's Engineer in Malabar.

2. When these types have been prepared and approved, they will be lithographed and copies will be sent to the different Governments in India.

ORDER—dated 16th June 1886, No. 1525 W., Public Works.

Communicated to the Financial Department, and to Superintending Engineers, with advertence to G.O., No. 269 W., dated 1st February 1886.

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Financial Department.
To Superintending Engineers.
To the Superintendent of Works, Tank Maintenance Scheme.
" Chief Engineer for Irrigation, with copy of G.O. No. 269 W.
" Examiner, Public Works Accounts.

Exd. E. Fernandez.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1886} Madras.

PUBLIC WORKS.

Dated June, 16th.

Read. *Encl.*

G.O., 16th June 1886, No. 1525 W.

JUNE.

Type Designs for Bridge Superstructures

Despatch from the Secretary of State intimating his having authorised preparation in England of —, communicated to the Financial Department and to Superintending Engineers.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following despatch from the Right Honorable VISCOUNT CROSS, Her Majesty's Secretary of State for India, to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 12th April 1888, No. 2, Public Works (Stores):—

In Lord Kimberley's despatch, in the Public Works Department, No. 2, of 20th May 1886, in reply to your letter in the same department, No. 2/269 W., of 1st February 1886, it was intimated that thirteen type designs for bridge superstructures would be prepared and lithographed, and that copies would be sent to India. In carrying out the work, however, it was found that it would be preferable to furnish twenty-three types of designs, as shown in the accompanying list.

2. The drawings are now nearly completed. They consist of complete designs and details of the various bridges, and I have given directions that those portions of the drawings which show the general construction of the bridges should be lithographed, and that 25 copies should be forwarded to your Government, with a similar number of copies of the necessary specifications. Such drawings will, it is hoped, be sufficient to enable engineers in India to select the type of bridge most suitable for any particular requirement, and to estimate its cost. The original detail drawings will be retained in this office for future guidance in dealing with indents from India.

ENCLOSURE.

List of Type drawings of Road-way Bridges.

	No. of Type Drawings.
Bridges rising by increments of 2 feet 6 inches from 5 feet to 10 feet clear span, with 9 feet 6 inches clear road-way	3
Ditto, ditto, with 14 feet 6 inches clear road-way	3
Bridge of 15 feet clear span, with 9 feet 6 inches clear road-way ...	1
Ditto, ditto, with 14 feet 6 inches clear road-way	1
Bridges rising by increments of 5 feet from 20 feet to 30 feet clear span, with 9 feet clear road-way	3
Ditto, ditto, with 14 feet clear road-way	3
Bridges rising by increments of 10 feet from 40 feet to 80 feet span centres bearings, with 14 feet clear road-way	5
Bridges rising by increments of 19 feet from 95 feet to 152 feet span centres bearings, with 14 feet clear road-way	4
Total number of Type drawings ...	23

ORDER—dated 11th May 1888, No. 1387 W., Public Works.

Communicated to the Local and Municipal Department, and to Superintending Engineers, in continuation of G.O. No. 1525 W., dated 16th June 1886.

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Local and Municipal Department.
To Superintending Engineers, including Periyár Project.
To the Chief Engineer for Irrigation.
" Consulting Architect to Government.

Exd. F. R. Bantleman.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1888} Madras.

PUBLIC WORKS.

Dated May, 11th.

Recd. *Encl.*

G.O., 11th May 1888, No. 1387 W.

MAY.

Bridges

Despatch from the Secretary of State for India regarding the submission of type drawings of road-way — for use of Engineers in India, communicated to the Local and Municipal Department, and to Superintending Engineers.

PUBLIC WORKS SECRETARIAT
MADRAS

2065/14

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers :—

From H. SEWELL, Esq., President, District Board, South Arcot, to the Chief Secretary to Government, dated Cuddalore, 8th June 1888, No. 439.

With reference to G.O., dated 25th ultimo, No. 988 L., passing orders on proposals made for the reconstruction of the bridges across the Ponniár and the Gadilam rivers, I have the honor to report that work on the former is going on under the sanction accorded in G.O., dated 29th September 1887, Mis. No. 1844 L., and the budget sanction for the current year. I am now issuing instructions to the Local Fund Engineer to arrange to complete a definite portion of the work, so that it may be carefully measured up and taken over by the Public Works Department officer who will eventually be deputed to superintend the two bridges.

2. No work has yet been commenced on the Gadilam bridge.

No. 292-D.

NOTE.

In continuation of my note, No. 181 D., dated 16th May 1888, I beg to say that I have now arranged to post for the special charge of the Gadilam and Ponniár bridges Mr. C. J. Peters, Executive Engineer, first grade, and that his posting will be duly notified in the next Gazette.

2. The work should be entrusted to Mr. Peters to be carried out in accordance with the ordinary rules of the Public Works Department.

3. The amount required for expenditure on the bridges will depend on whether any payment has to be made in England for iron-work. Exclusive of this, a sum of Rs. 30,000 for each bridge will probably suffice.

(Signed) J. O. HASTED, Col., R.E.,
Secy. to Govt., P.W.D.

8th June 1888.

To the Chief Secretary to Government, Local and Municipal Department.

G.O., dated 15th June 1888, No. 1777 W., Public Works.

Read—the following paper :—

G.O., dated 25th May 1888, No. 988 L., Local and Municipal.

ABSTRACT.—Accepting the proposal of the President, South Arcot District Board, that the reconstruction of the Ponniár and Gadilam bridges should be undertaken by Government, and requesting the Public Works Department to depute a special officer for the work.

Order—dated 15th June 1888, No. 1777 W., Public Works.

Communicated to the Superintending Engineer, V Circle, for information.

2. Mr. C. J. Peters, Executive Engineer, first grade, having been posted to the charge of the construction of the bridges, the requisite funds may now be placed at the disposal of the Public Works Department.

(True Extract.)

(Signed) W. L. C. BADDELEY, Captain, R.E.,
Under Secy. to Govt., P.W.D.

To the Local and Municipal Department.

No. 337-D.

MEMORANDUM.

In reply to memorandum, dated 15th June 1888, from the Chief Secretary, Local and Municipal Department, inquiring the sum wanted for expenditure during the current official year on the Gadilam and Ponniár bridges, the Public Works Secretary invites attention to paragraph 3 of his Note, No. 292 D., dated 8th June 1888, wherein it is stated that the amount will depend on whether any payment has to be made in England for iron-work, and that, exclusive of this, a sum of Rs. 30,000 for each bridge will probably suffice. A special grant will be necessary.

(Signed) J. O. HASTED, Col., R.E.,
Secy. to Govt., P.W.D.

OOTACAMUND,
18*th June* 1888.

To the Chief Secretary to Government, Local and Municipal Department.

ORDER—dated 28th June 1888, No. 1198 L., Local and Municipal.

The papers from the Public Works Department read above will be communicated to the District Board, South Arcot, and the Municipal Council, Cuddalore.

2. An allotment of Rs. 4,000 is sanctioned from the District Fund reserve for expenditure on the Ponniár bridge, in addition to the sum of Rs. 36,000 provided in the current year's budget, as also a further allotment of Rs. 10,000 from the same source for payment of the contribution promised by the District Board for the Gadilam bridge in the current year. The Accountant-General is requested to instruct the Treasury officer to credit to Government the total sum of Rs. 50,000 thus sanctioned for these bridges.

3. The Municipal Council is requested to pay into the treasury, to the credit of Government, the sum of Rs. 5,000 provided for the Gadilam bridge in the current year's municipal budget.

4. The allotment of Rs. 60,000 applied for in paragraph 3 of the Public Works Department office note, dated 8th June 1888, will be sanctioned in the Financial Department.

(True Extract.) H. E. STOKES,
Chief Secretary.

To the President, District Board, South Arcot.
" Chairman, Municipal Council, Cuddalore,
through the Collector of South Arcot.
" Accountant-General.
" Financial Department.
" Public Works Department, with copy of
G.O., dated 29th Sept. 1887, Mis. No. 1844 L.

Ed. A. Raitt.

Order thereon

Communicated to the Superintending Engineer V. Circle for information and continuation of G.O. no 1984 W dated 3d July 1888.

Copy of G.O.

Govt. of {1888} Madras.

LOCAL AND MUNICIPAL.

Issued

Recd. Encl.

G.O., 28th June 1888, No. 1198 L.

JUNE.

Ponniar and Gadilam Bridges.

Communicating to the District Board, South Arcot, and the Municipal Council, Cuddalore, papers relating to the reconstruction of the —, and stating that the allotment of funds applied for will be sanctioned in the Financial Department.

Sd. V Circle
Examd. & d.

2669/16

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Account.

READ—the following papers :—

From Colonel H. M. VIBART, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, dated Chepâk, 17th August 1888, No. 2208.

I have the honor to forward the plan s, &c., for the iron girders for the Gadilam bridge, South Arcot—

1 Tracing sheet, No. 2.
1 do. No. 3.
1 do. General elevation of two spans and section.
1 Sheet of calculation (19 pages).

2. I understand that you considered it would be desirable to have the piers 7 feet thick without batter, instead of 8′ 6″ at bottom and 6 feet at top. The span will then be 61 feet in the clear instead of 62.

3. Although these plans, &c., are to be forwarded to England, so that the iron work may be obtained from Home, Mr. Peters informs me that you considered girders of the same pattern as the "type designs" would be far preferable, as all the members being connected by pins there would be no riveting to be done in this country.

4. The width of roadway allowed in the type designs is only 14 feet, whereas it will be necessary to arrange for obtaining girders which will carry a roadway of 18 feet width.

5. It is more than probable that the design herewith forwarded will be revised in England, so it was not considered necessary to alter the original drawings which are intended for a clear span of 62 feet.

6. In ordering the girders, &c., the following points should be noted—

(1) There are to be 13 spans of 61 feet clear.
(2) The width of roadway is to be 18 feet.
(3) All the members of the girders to be connected by pins to avoid riveting in this country.
(4) Floor to be carried on buckle plates instead of planking.

7. Mr. Martin took the live-load on the bridge at 100 lb. per square foot. In the type design it is taken at 120 lb.

8. In the design sent up by Mr. Martin, buckle plates are allowed for an average thickness of gravel ·63 foot. In the type designs planking is allowed with several inches thickness of gravel. It is thought that the buckle plates will be more lasting than the planking.

9. Mr. Martin's calculations of the girders accompany the plans which have not been altered except the small scale elevation and section of two bays which show the slight alteration proposed in the design.

10. It would be as well if the iron work was to reach this country in January. The cost of it could then readily be adjusted before the close of this official year.

ENCLOSURE.

From C. J. PETERS, Esq., Executive Engineer, in charge of Ponniár and Gadilam bridges, to the Superintending Engineer, V Circle, dated Cuddalore, 12th August 1888.

In accordance with the Chief Engineer's instructions, I have the honor to forward herewith the plans for the iron girders for the Gadilam bridge.

2. The Chief Engineer considered that the following alterations should be made in the design :—

The piers to be vertical and 7 feet thick from bottom to top instead of 8′ 6″ at bottom and 6 feet at top.

The span to be 61 feet clear instead of 62.

3. Although these plans are to be forwarded to England with the indent for the girders, it was considered that girders of the same pattern as the "type designs" would be far preferable, as all the members being connected by pins there would be no riveting to be done in this country.

4. As, however, none of the type designs have a greater width of roadway than 14 feet, it will be necessary to work out girders for a clear width of roadway of 18 feet.

5. As in any case it is probable that the design herewith forwarded will be revised in England, it was not considered necessary to alter the original drawings which are intended for a clear span of 62 feet.

6. Briefly the following are the main points to be noted in ordering the girders :—

(1) There are to be 13 spans of 61 feet clear.
(2) Width of roadway 18 feet clear.
(3) All the members of the girders to be connected by pins to avoid riveting at the site.
(4) Floor to be carried on buckle plates instead of planking.

7. I observe that Mr. Martin takes the live-load on the bridge to be 100 lb. per square foot. I think in the type designs it is taken as 120 lb.

8. As regards the dead-load, the buckle plates may make a slight difference and Mr. Martin allows for 63 thickness of gravel which amounts to about 80 lb. per square foot. I do not recollect what the weight allowed for gravel, &c., is in the type designs.

9. Mr. Martin's calculations of the girders accompany the plans which have not been altered except the small scale elevation and section of two bays which show the alterations in the design.

Office note from the Examiner, Public Works Accounts, dated Madras, 27th September 1888, No. 2325.

With reference to the accompanying letter No. 2433 A, dated 6th September 1888, from the Superintending Engineer, V Circle, forwarded to the Chief Engineer, Public Works Department, through me with an indent in triplicate for a wrought iron lattice girder bridge for the Gadilam river, I have to observe that the value of the bridge is not stated and I am unable to furnish the certificate prescribed by Code appendix G, para. 16.

2. In the note from the Chief Engineer, Public Works Department, No. 292 D, dated 8th June 1888, printed with Proceedings communicated with G.O., No. 2157 W., dated 16th July 1888, it is stated that exclusive of any payment to be made in England for iron works, a sum of Rs. 30,000 for each bridge will probably suffice, that is, Rs. 60,000 for the two bridges over the Gadilam and Ponniár rivers.

3. Arrangements are now being made to place a grant of Rs. 1,15,000 from Local Funds at the disposal of this department for the two bridges.

4. Please therefore inform me how much of the grant may be considered as set apart to meet the expenditure in England on account of this indent.

ENCLOSURE.

From Colonel H. M. VIBART, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department (through the Examiner of Public Works Accounts), dated Bangalore, 6th September 1888, No. 2433 A.

With reference to your memorandum No. 580 D., dated 27th August 1888, I have the honor to forward an indent (in triplicate) for a wrought iron lattice girder bridge for the Gadilam river in Cuddalore.

2365/17

ORDER—dated 6th October 1888, No. 3131 W., Public Works.

Ordered that the indent be transmitted to the India office for compliance with request that the cost of the bridge work be intimated to this Government in view to the requisite funds being set apart for payment.

(Here enter No. 3132 W., dated 6th October 1888.)

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintending Engineer, V Circle.
" Examiner, Public Works Accounts.
" Local and Municipal Department.

LETTER—to the Director-General of Stores, India Office, London, dated Ootacamund, 6th October 1888, No. 3132 W.

I am directed to forward herewith an indent, in duplicate, for the iron work required for the Gadilam bridge in the South Arcot district.

2. The indent is accompanied by three tracings and a sheet of calculations. Tracing No. I shows the general elevation of two spans of the bridge, with cross section, and it is proposed to build the bridge in accordance with the modifications of the design here given. The other plans * are forwarded unaltered, as it is probable that they will be revised in the India office; but I am to request that the iron work may be prepared so as to allow for thirteen spans of 61 feet clear, the piers being 7 feet thick as shown in plan No. I.

* Nos. II and III.

3. The girders should be of the same pattern as those shown in the "type designs," all the members being connected by pins, so that there would be no riveting to be done in this country.

4. The width of roadway allowed in the type design is 14 feet, but the girders now indented for are intended to carry a roadway of 18 feet width. The floor is to be carried on buckle plates instead of planking, and the live-load is to be taken at 120 lb. per square foot as in the type design.

5. It is desired that the iron work should, if possible, reach this country by January, and that meanwhile the probable cost of the bridge work be intimated to this Government in view to the requisite budget provision being made to meet it.

(Here enter No. 3133 W., dated 6th October 1888.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

ENDORSEMENT—dated 6th October 1888, No. 3133 W., Public Works.

Copy of the above, with copy of indent, forwarded to the Government of India for information.

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

Exd. J. Henricus.
Spare Copies

GENERAL.
ACCOUNT.

Govt. of {1888} Madras.

PUBLIC WORKS.

Dated October, 6th.

Recd. *Encl.*

G.O., 6th Oct. 1888, Nos. 3131, 3132, 3133 W.

OCTOBER.

Cadilam Bridge, South Arcot District

Forwarding copy of indent for iron wo
required for the —.

PUBLIC WORKS SECRETARIAT
MADRAS

2865/18

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers:—

From A. A. JOPP, Esq., Director-General of Stores, to the Secretary to the Government of Madras, Public Works Department, dated India Office, Whitehall, S.W., 16th November 1888, No. S. 14734.

With reference to your letter, No. 3132, of 6th October 1888, transmitting an indent for iron work for the Gadilam bridge, South Arcot, I have the honor to forward a copy of a report on the subject by the Consulting Engineer to this office.

2. You will observe that Sir A. Rendel prefers the design sent home from Madras to the type design referred to in your letter, and that, in his opinion, the latter cannot be adopted as it stands for this bridge.

3. Fresh designs have therefore been prepared, based on both the above plans, and they are sent herewith for your consideration. The estimated cost per span of each design, including freight, is given in the enclosed report, from which it will be seen that the total estimated cost of the 13 spans (including freight) is —

	£	s.	d.
For type design	8,482	10	0
For rivetted design	6,298	10	0

4. I suggest that your decision as to the type of bridge to be supplied be communicated by telegraph.

5. I may add that it would not, in any event, have been possible for the iron work to arrive at Madras by January next.

ENCLOSURE.

REPORT by Sir A. M. RENDEL, Consulting Engineer, India Office, dated 16th November 1888.

I very much prefer the design sent home to the type design for 60 feet and 70 feet spans. The only justification for adopting the type, in my opinion, would be the impossibility of obtaining rivetters in the part of India to which the girders are to be sent. I should doubt its being more difficult to get them anywhere than to get the class of men required to properly erect the type girders. As to the supposed superiority of pins over rivets, I have more failures of pinned girders than of rivetted girders. For instance, pinned girders sent out for the East Indian Railway 35 years ago are now being re-placed by rivetted girders in consequence of the deterioration of the pins by rust.

2. In respect to the roadway, under the circumstances of this case, I agree with the opinions expressed in India that a wrought iron flooring covered with from 6 to 9 inches of gravel on it is to be preferred to the timber planking with a thin coating of gravel and asphalte shown in the type designs for 60 and 70 feet spans. But such a roadway is much heavier than that of the type design, and would add materially to the quantity of material in the girders.

3. We cannot adopt the type design as it stands for many reasons. For instance, the girders required are about 65 feet centre to centre, the nearest type is 60 feet. The type roadway is 14 feet wide. The roadway asked for is 18 feet wide, and is not only wider but as I have said much heavier per square foot. A new design is therefore necessary in any case.

4. I have prepared two designs, which I think should be considered in India before we order the work. One is based on the type, the other on the design sent home, the roadways being similar in width and character in each case. The essential difference is that the type design will be put together in India with pins and bolts and nuts, the other with rivets.

5. The weight of the type design will be girders 22½ tons, roadway 22½ tons, or 45 tons in all. That of the other design will be 19 tons for the girders and 19 tons for the roadway, or 38 tons in all. In point of cost the girders of the type design will be fully £2-10-0 a ton dearer than those of the other. I should estimate the cost of each as follows :—

Type design.

	Per Span. £	s.	d.
Girders, 22½ tons, at £14-10-0 = ...	326	5	0
Flooring, 22½ tons, at £12-0-0 = ...	270	0	0
Total cost in England ...	596	5	0
Freight to India, 45 tons, at 25	56	5	0
Total ...	652	10	0

Rivetted design.

Girders, 19 tons, at £12 = ...	228	0	0
Flooring, 19 tons, at £11 = ...	209	0	0
Total cost in England ...	437	0	0
Freight to India, 38 tons, at 25	47	10	0
Total ...	484	10	0

and I should have said that erection would be about the same for each, but local opinion would be better than mine on such a point.

6. The rivetted design would be sent out, as to the top and bottom booms, each in two or at the most three pieces fully rivetted up, except the gusset plates. The cross girders would of course be sent out rivetted up. The amount of rivetting to be done in India would not be large, and I should provide that the rivets should not be more than ¾ inch diameter so that they would not require any great strength to close them. The type design would be put together in India entirely with bolts and nuts.

7. Steel must be used for the channel bars in both designs because good iron channel bars cannot be got. In fact the principal parts of both designs would be steel used at the strains allowed for iron at the most. Steel is so little dearer than good iron, if at all, that this involves no waste. The supposed greater tendency to rust of steel need not, I think, be considered, and I should not shape out the bars in the type design. Forging is out of date or impossible, and the material saved by shaping does not pay for its cost.

8. Having said so much, it is for the authorities in India to say which or what other design they will have, but I have no doubt, in my own mind, that the type design is not nearly so good as the other.

9. In order that as little time may be lost as possible by a reference to India, I am having contract drawings for each design prepared, so that on receipt of a telegram tenders may be at once invited for the design selected.

10. I may perhaps say in conclusion that I prefer to either design for such a span plate girders. I do not propose them, because they will weigh, including roadway, say, 42 tons, and would involve the transport of large and heavy masses as well as rivetting in India.

Note by the Chief Engineer, Public Works Department.

The Director-General of Stores, India Office, with his No. S 14734 of 16th November 1888, forwards revised designs for the iron work required for the Gadilam bridge, prepared under the orders of Sir A. Rendel.

2. Sir A. Rendel considers that the designs for the girders sent from Madras are better than the type designs received some time ago from the India Office. The plan of the girders sent from here was designed by Mr. Martin.

3. In any case the difference of span and the width of roadway between the type design and the girders required for the Gadilam bridge is such that new designs have been found necessary, and two have accordingly been prepared.

(*a*) Based on the type designs—	(*b*) Based on Mr. Martin's design —
Cost per span £652-10-0.	Cost per span £484-10-0.

As there are 13 spans, the cost of the iron work for the whole bridge will be (*a*) £8,482-10-0, (*b*) £6,298-10-0.

4. In this case there will be no difficulty in obtaining rivetters from the Railway or Public Works Workshops, so that there will be no advantage in adhering to the type design for pinned girders for the Gadilam bridge; but I feel sure that, in a large number of cases, the difficulty of obtaining rivetters will make it advisable to use the pinned girders shown in the type designs, and although pinned girders do wear out more rapidly than rivetted ones when there are frequent and heavy live loads, this argument does not apply to bridges where the live load consists of country carts.

5. I would recommend that the following telegram be despatched to the Director-General of Stores :—

"Rendel's design rivetted girders approved."

(Signed) H. R. MEAD, Col., R.E.,
8th December 1888. Ag. Chief Engineer, P.W.D.

Order—dated 11th December 1888, No. 3891 W., Public Works.

Approved.

(True Extract.)

(Signed) H. R. MEAD, Colonel, R.E.,
Ag. Secretary to Govt., P.W.D.

To the Superintending Engineer, V Circle, with two plans.

Exd. J. Moses.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1888} Madras.

PUBLIC WORKS.

Dated December, 11th.

Recd. *Encl.*

G.O., 11th Dec. 1888, No. 3891 W

DECEMBER.

Gadilam Bridge

Sir A. Rendel's design for rivetted girders for the —, approved, and the Director-General of Stores, India Office, informed accordingly by telegraph.

2548/20

19TH FEBRUARY 1889, No. 499 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Account.

READ—the following paper: —

From Colonel W. H. BURTON, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department (through the Examiner of Public Works Accounts), dated Chepâk, 27th November 1888, No. 3885.

I have the honor to forward herewith a special indent in triplicate on the Home Government for certain works required for Talavasal bridge, Salem district, together with two tracings, a specification and a report furnished by the Superintending Engineer, IV Circle.

Office-note from the Examiner of Public Works Accounts, dated Madras, 14th February 1889, No. 200.

The accompanying letter from the Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, No. 3885, dated 27th November 1888, with an indent for English stores for transmission to the Secretary of State is forwarded for necessary action with the usual certificate.

Certificate.

I certify that funds to meet the estimated outlay in England in connection with this indent during the year 1889-90 will be provided by the Local Government to the extent of £3,032 in the estimate of the Public Works Department for that year.

(Signed) C. H. P. CHRISTIE, Major, R.E.,
Examiner, Public Works Accounts.

ORDER—dated 19th February 1889, No. 499 W., Public Works.

Ordered that the indent be forwarded to the Director-General of Stores for favor of compliance.

(Here enter Nos. 500-501 W., dated 19th February 1889.)

(True Extract.)

(Signed) H. R. MEAD, Colonel, R.E.,
Ag. Secretary to Govt., P.W.D.

To the Superintending Engineers, IV and V Circles.
„ Examiner, Public Works Accounts.
„ Local and Municipal Department.

Exd. A. D. Xavier.
Spare Copies

GENERAL.
ACCOUNT.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated February, 19th.

Recd. *Encl.*

G.O., 19th Feb. 1889, No. 499 W.

FEBRUARY.

Talavasal bridge, Salem district

Ordered that the indent for certain iron works required for the — be forwarded to the Director-General of Stores for compliance.

PUBLIC WORKS DEPARTMENT.

General
Account.

LETTER—from

COLONEL H. R. MEAD, R.E.,
Ag. Secretary to the Government of Madras,
Public Works Department,

To

THE DIRECTOR-GENERAL OF STORES,
INDIA OFFICE, LONDON.

SIR,

I have the honor to forward, herewith, for favor of compliance, an indent in duplicate, accompanied with two tracings, a specification and a report, for certain iron works required for the Talavasal bridge in the Salem district.

2. The usual certificate in regard to funds will be found embodied in the accompanying Proceedings.*

* No. 499 W., dated 19th February 1889.

I have the honor to be,
Sir,
Your most obedient servant,

(Signed) H. R. MEAD, Colonel, R.E.,
Ag. Secretary to Govt., P.W.D.

FORT ST. GEORGE,
19th February 1889.

Exd. A. D. Xavier.
Spare Copies

GENERAL.
ACCOUNT.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated February, 19th.

Read. *Encl.*

19th Feb. 1889, No. 500 W.

FEBRUARY.

Talavasal bridge, Salem district

Forwarding indent for certain iron works required for the —.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—again the following papers:—

G.Os., No. 3891 W., dated 11th December 1888, and No. 1076 W., dated 22nd April 1889, in which are recorded reports by Sir A. Rendel, Consulting Engineer, India office, on the superstructure of the Gadilam and Talavasal bridges.

READ—also the following paper:—

Note by the Chief Engineer, Public Works Department.

Type designs for the superstructure of iron bridges are an admitted necessity for Engineers in India, and with the object of supplying this want a number of type designs were recently obtained from the India office.

G.O., No. 1525 W., dated 16th June 1886.
" " 1387 W., " 11th May 1888.
" " 2328 W., " 31st July "

2. The bridges included in these designs vary from 5 to 152 feet span and may be divided into three main classes—

(1) Those in which the floor plates are used as girders.
(2) Those with rolled iron girders.
(3) Those with Whipple-Murphy trusses.

It will be observed that the list does not include any plate, Warren or lattice girders.

3. Owing to the difficulty of obtaining skilled labor for erecting iron bridges it was considered that pinned bridges would be preferable to riveted ones, and in the type designs furnished there are no members which would require to be riveted in India.

4. From Sir A. Rendel's reports on the Gadilam and Talavasal bridges it appears probable that the advantages of pinned girders have been overestimated, and as there is strong evidence to show that riveted bridges are ordinarily both cheaper and stronger, it is desirable that a further selection of type designs should be prepared to enable Engineers to select a bridge which would be most suitable in reference to the part of the country in which it has to be erected.

5. The assistance afforded by these type designs in estimating and indenting for bridgework is very great, and while admitting that there must be many cases in which the existing type designs will answer all requirements, the Chief Engineer strongly recommends that the list should be made more complete by the addition of plate, lattice and other riveted designs for iron bridges.

6. The new standard designs should comprise bridges from 5 to 150 feet span, but in those cases where no decided improvement can be effected upon the existing types, as appears probable in some of the smaller spans, it will be sufficient to omit such spans from the list.

7. Owing to the demand for these standard designs, it is considered that at least 200 copies of each should be supplied for distribution.

(Signed) R. R. E. DRAKE-BROCKMAN, Lieut.-Col., R.E.,
17th June 1889. Acting Chief Engineer, P.W.D.

ORDER—dated 28th June 1889, No. 1718 W., Public Works.

Ordered that the following letter be addressed to the Secretary of State for India.

(Here enter No. $\frac{14}{1718}$ 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.

Exd. J. Henricus.
Spare Copies

2069/23

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated June, 28th.

Recd. *Encl.*

G.O., 28th June 1889, No. 1718 W.

JUNE.

Type Designs

Ordered that the Secretary of State be requested to have a series of — for superstructure of girder bridges prepared upon the basis of Sir A. Rendel's remarks, and that two hundred copies may be supplied for distribution in the Public Works Department and among Local Fund Boards.

PUBLIC WORKS SECRETARIAT
OOTACAMUND.

208/24

PUBLIC WORKS DEPARTMENT.

LETTER—to

THE RIGHT HONORABLE THE SECRETARY OF STATE FOR INDIA.

MY LORD,

We have the honor to forward, for your Lordship's consideration, copy of our Proceedings marginally noted, relative to the type designs for bridge superstructures lately supplied to this Government.

G.O., No. 1718 W., dated 28th June 1889.

2. Standard designs for the superstructure of iron bridges are necessary for the guidance of officers of the Public Works Department and Local Fund Boards, and as it is doubtful whether the designs for pinned girders already furnished by the Director-General of Stores possess any marked advantage over the riveted girders which are recommended by Sir A. Rendel as being both stronger and cheaper than pinned girders, we beg to recommend that a series of type designs be prepared upon the basis of Sir A. Rendel's remarks.

3. The Chief Engineer, Public Works Department, is of opinion that the list of standard designs should be similar to the one contained in your Lordship's despatch No. 2, Public Works (Stores), of 12th April 1888, and that two hundred copies of each design should be supplied for distribution in the Public Works Department and among Local Fund Boards, and his recommendations have our approval.

We have the honor to be,
My Lord,
Your Lordship's most obedient, humble servants,

(Signed) CONNEMARA.
(„) C. G. ARBUTHNOT.
(„) H. E. STOKES.
(„) J. H. GARSTIN.

OOTACAMUND,
28th June 1889.

Exd. J. Henricus.

2669
25

GOVT. OF MADRAS.

PUBLIC WORKS DEPARTMENT.

(Copy)

LETTER to the Right Honorable the Secretary of State for India.

No. $\frac{14}{1718\ W.}$, dated 28th June 1889.

Recommending the preparation of a series of type designs for superstructure of girder bridges upon the basis of Sir A. Rendel's remarks, and that two hundred copies may be supplied for distribution in the Public Works Department and among Local Fund Boards.

PUBLIC WORKS SECRETARIAT
OOTACAMUND.

PUBLIC WORKS DEPARTMENT.

LETTER—to

THE RIGHT HONORABLE THE SECRETARY OF STATE FOR INDIA.

MY LORD,

We have the honor to acknowledge the receipt of your Lordship's despatch, No. 1, dated 20th June 1889, enclosing copy of a report by Sir A. Rendel recommending that a new series of designs be prepared for riveted bridges for 40 feet, 50 feet, 60 feet, 70 feet and 80 feet spans.

2. In reply, we would invite attention to the proposals made in our despatch, No. $\frac{14}{1718\ W.}$, dated 28th June 1889, which are similar in character with those put forward by Sir A. Rendel, but embrace a larger series of designs ranging from 5 to 150 feet span. We now desire that the matter may be left to Sir A. Rendel's discretion, not only as regards the designs, but also as regards the number of intermediate spans for which new designs should be prepared. It is, however, important that the series should be as complete as possible.

3. Two hundred lithographed copies of each of the new types will be required for distribution here.

4. We would further invite attention to the accompanying copy of a note by Mr. Anderson, Engineer to the Malabar Local Board, and of the letter of the President of the Board, recorded with our Proceedings, No. 1964 W., dated 20th July 1889. It will be seen that these officers consider that existing types provide for much greater loads than are usual in the localities where the bridges are to be placed, and that their adoption thus entails unnecessary cost on Local Boards. We are aware that the adoption of the type designs is not incumbent on the authorities in this country, but it seems worthy of consideration whether lighter designs more suited to local circumstances should not be provided for.

We have the honor to be,
My Lord,
Your Lordship's most obedient, humble servants,

(Signed) CONNEMARA.
(„) C. G. ARBUTHNOT.
(„) H. E. STOKES.
(„) J. H. GARSTIN.

OOTACAMUND,
1st August 1889.

Exd. P. L. Pereira.

GOVT. OF MADRAS.

PUBLIC WORKS DEPARTMENT.

(Copy.)

LETTER to the Right Honorable the Secretary of State for India.

No. 15/2069 W. dated 1st Aug. 1889.

Acknowledging receipt of despatch forwarding report by Sir A. Rendel recommending preparation of a new series of designs for riveted bridges and inviting attention to despatch, No. 14/1718 W., dated 28th June 1889, from the Madras Government, containing proposals of a similar character.

India Office,
London, 20th June 1889.

Public Works (Stores),
No. 1.

To His Excellency The Right Honourable The Governor in Council, Fort St. George.

MY LORD,

With reference to my Despatch in this Department, No. 2, dated 12th April 1889, regarding the supply of type designs for road bridges, I forward, for your Lordship's information, a copy of a report* by the Consulting Engineer to this Office, recommending that a new series of designs be prepared for riveted bridges for 40-feet, 50-feet, 60-feet, 70-feet, and 80-feet spans.

* Dated 1st May 1889.

2. The three indents referred to in the report as having been received for bridge work in accordance with the existing type designs, are quoted in the margin.† In each of these cases the Consulting Engineer suggested that plate girder riveted bridges would be cheaper and better than the pinned trusses shown in the type designs; and, on further reference being made to indenting officers, they eventually agreed to the Consulting Engineer's suggestions.

† Indent for Gadilam Bridge, South Arcot, forwarded with letter from the Secretary to the Government of Madras in the Public Works Department, No. 3132, of 6th October 1888.

Indent for a bridge in Berar, forwarded with letter from the Secretary to the Resident, Hyderabad, Public Works Department, No. 54 G. A., of 13th February 1889.

Indent for the Talavasal Bridge, forwarded with letter from the Secretary to the Government of Madras in the Public Works Department, No. 500 W., of 19th February 1889.

3. It does not appear desirable that Engineers in India should be too rigidly bound to indent for bridge work in accordance with the existing designs, and it is thought that, with the assistance of the proposed new designs, they will be in a better position to decide what kind of bridge is most suitable for their several requirements. With this view, instructions have been given for the preparation of the designs, and I request that I may be informed how many lithographed copies will be required.

I have the honour to be,
My Lord,
Your Lordship's most obedient humble Servant,

18515. I. 1299.

ENCLOSURE.

Report by Consulting Engineer, dated 1st May 1889.

Many of the type drawings seem more suited to special and therefore rare cases than to ordinary and therefore common cases. We have now had indents for three road bridges in which simple plate girders riveted up were evidently cheaper and better than the pinned trusses shown on the types, and which have been preferred to the types by the authorities in India when their attention has been called to the matter. Moreover, all the types above the span of 30 feet provide timber floorings, whereas India evidently, and I think rightly, prefers iron floorings in all ordinary cases.

The type designs show rolled girders with corrugated iron floorings bolted to them up to 30 feet span. For larger spans, the types show what they call pony trusses pinned together and with timber floorings, the object in all the designs being apparently to avoid riveting and to diminish the quantity of ironwork as much as possible, even at the cost of using a great deal of timber, which is quite as expensive in India as iron. Now riveting presents difficulties in very few parts of India, and is better than pins where possible, and metalled roads are better than timber roads, and through requiring heavier main girders are usually cheaper as well as more durable. I would therefore recommend that we add to the type drawings a new series, consisting of plate girders for 40-feet, 50-feet, and 60-feet spans riveted up, and floored with corrugated iron riveted to the main girders, and carrying a metalled roadway; and, as there is no difficulty as a rule in placing the main girders of a road bridge under the roadway in spans up to 60 feet, I should so place them in these cases. I would also propose to add new types for 70 and 80 feet girders, in which the main girders would be of the lattice or truss description riveted together, with corrugated iron floorings riveted to them, resting on cross girders and carrying a metalled roadway. In these cases, the roadway would be laid between the main girders and rest on their bottom flanges. Timber would thus be wholly absent, except as curbs to keep carts off the handrails, in all the types up 80 feet.

In respect to width the type drawings show for all the sizes I am dealing with a width of 14 feet in the clear. In two of the three cases I have had to deal with this width has been asked for, but I suspect only because it was the width of the type. In the third case the width asked for was 18 feet, and I have a case before me, where the type drawings are not referred to, in which a width of 9 feet is asked for.

I would suggest that the new types be prepared for two widths, 12 feet and 18 feet. The same main girders might be used for anything less than 12 feet, and up to 14 feet, and probably 18 feet is the greatest width ever likely to be wanted.

I cannot well estimate the cost of the new types, but the drawings would be prepared in my office at times when the work in it is slack, and the real extra expenditure caused by them would not be large, not more than 150*l*.

No. 4. ✓
P.W.C. No. 6442

Pub. Cus.

Public Works
(Stores)
20th June 1889.

The
Secretary to Govt. St. George
No. 1 enclosure.

Rd 10.7.89.

Rd 13.7.89

Los 499-500 N. 13.2.89.
2 typ. 4.2.89.
2 typ. 6.2.89.
1250 - 16.6.89.
1307 N - 11.5.89.
1425-26. 16.7.89.
1431-2-36-6-10-89.
1502 N - 11.12.88.
1 typ - 28.1.89
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1964 typ dy 20-7-89

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PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the

READ the following

Despatch from the Secretary of State for India
No. 1 dy 20 June 89.

Ordered that the
following reply be sent.

M.E. No. 15/1494 dy 1st Sept

To

The Right Honorable
the Secretary of State
for India

My Lord,

We have the honor
to acknowledge the receipt
of your Lordship's Despatch
No. 1 dy 20 June 89, enclosing
copy of a report by Sir A
Rendel recommending that
a new series of designs be
prepared for riveted bridges
for 40 feet, 50 feet, 60 feet,
70 feet and 80 feet spans.

2. In reply we would

Ret
17/9/89

invite attention to the proposals made in our Despatch No. 4 17/8/89 d/28 June /89, which are similar in character with those put forward by Sir. A Rendel, but embrace a larger series of designs ranging from 5 to 150 feet span - We now desire that the matter may be left to Sir. A. Rendel's discretion, not only as regards the designs, but also as regards the number of intermediate spans for which new designs should be prepared. It is, however, important that the series should be as complete as possible.

3. Two hundred lithographed copies of each of the new types will be required for distribution here.

4. We would further

258 31 48

invite attention to the accompanying copy of a note by Mr. Anderson - Engineer to the Malabar Local Board, and of the letter of the President of the Board, recorded with our Proceedings No. 1964 Dy 20th July /89. It will be seen that these officers consider that existing types provide for much greater loads than are usual in the localities where bridges are to be placed, and that their adoption thus entails unnecessary cost on Local Boards. We are aware that the adoption of the type designs is not incumbent on the authorities in this country, but it seems worthy of consideration whether lighter designs more suited to local circumstances should not be provided for.

Desp'd 3/8/89

Pmeon
16.7.89

R.S.

Govt. of Madras. 1889

PUBLIC WORKS.

Dated August 1889

Rcd. Encl.

G.O., 1st August 89 No. 2067

15

2067

Bridges.

Ordered that the Secy of State for India be addressed in reply to his Lordships despatch forwarding report by Sir A. Rendel recommending that a new series of designs be prepared for riveted ~~bridges~~ - for 40, 50, 60, 70 & 80 ft. spans

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Acknowledge receipt of despatch ~~No. 1 of 3 Augt 89~~ forwarding report by Sir A. Rendel recommending preparation of a new series of designs for riveted ~~bridges~~ girders and pier-staging ~~bridges~~ and pier staging ~~bridges~~ to ~~two parts~~ ~~made in~~ despatch ~~from the Madras Govt~~ No 14 of 1718 of 7 June 89 from the Madras Govt. ~~from~~ forwarding proposals of a similar character.