(1) பக்கங்களின் எண்ணிக்கை 80

(2) புதுக்கித் திருப்பிய நாள் 04-89

(3) ஆதாரங்குறிப்பவர் சுருக்கொப்பம்

தமிழ்நாடு ஆவணக் காப்பகம்.

(23)

தமிழ்நாடு அரசு

P. W. D. துறை

அரசாணை எண்.	அச்சகம்
மு. கோப்புத் தாள் எண். 1964	பலவகை

நாள் : 20-7-1889 198 .

...ுக்கவோ கண்டபடி கையாளவோ கூடாது

Date

40. Shots

27+13 Shots 39+40 set & numbering

[.13 எதிர்க்கப்பட்டது]

...ணை. தா-1—18,000—15-6-87.

1964

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

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 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

1964.

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

1964

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.

3

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		
30 ,, ...	91	152
40 ,, ...	136	228
60 ,, ...	182	304
80 ,, ...	273	456
100 ,, ...	364	608
150 ,, ...	455	760
200 ,, ...	682	1,140
	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.

1964

1994 of 89

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.

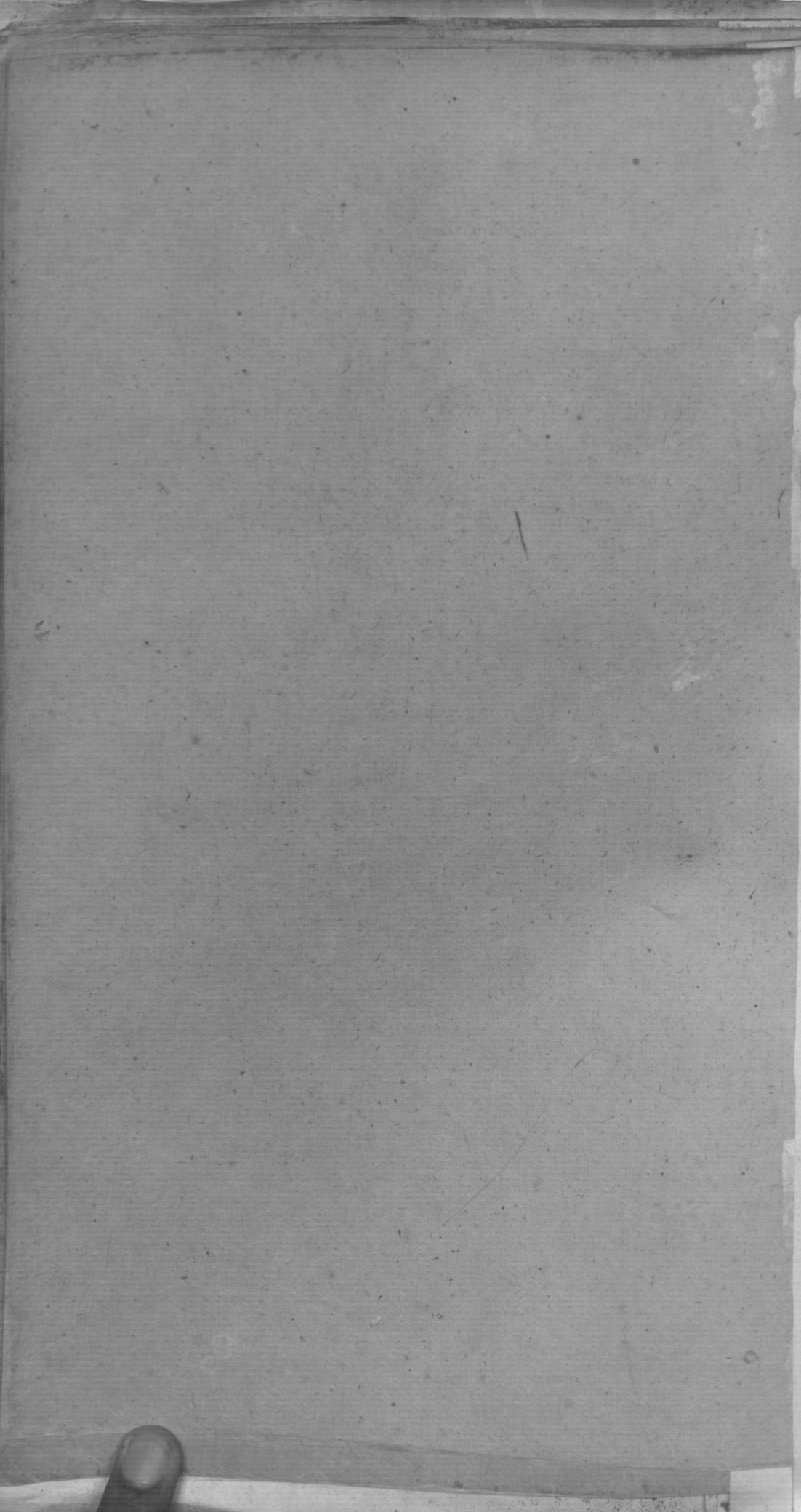
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Truss Bridges.

1	2	Reconstructing Irvity Bridge with Whipple-Murphy Pony Truss Iron Girders	1	72	76	145 1576/1240 =145.712	45,203 8	1	2344	scaffolding	4	2,546	4069	1	11	"	"	"	57,616	1010	14	89334	"	27	10
2	2	Reconstructing Ineremmpoya Bridge with Da Da Da	3	72	76	62 1569/2240 =62.701	18,742	11	5.916	19	1043	1663	6	"	"				21,322	3	11	14	37788	"	16	15
3	1	Reconstructing Harrisonpanatel bridge with Da Da Da	1	32	34	7.547	2,526	6	223.46		150.87	272	5	10	97	15	"		3120	15	7	14	4110	"		
		Total				215.960	66,472	10	3483	6	3789.87	6005	14	11												

Rolled Iron Beams Bridges.

4	1	Constructing Papenshurg bridge with Rolled Iron Beams and wooden platforms	1	8	9/2	Iron 0.385	77	01	"	"	76.24	103	7	8	11	9	"	192	9	9	575	"	"	100	22	"
5	1	Constructing Idakaad bridge with Da Da Da	3	25/2	27/2	10.56	1,758	16	11	"	473.44	889	10	8	156	13	6	2805	81	14	6930	"	"	656	260	"
6	27	Da Mamakaye bridges with Da Da Da	3	19 2/16	23 1/4 17 3/4	2.891	482	17	32	15	314.69	466	15	10	39	6	"	1020	8	10	6	2071	"	1017	748	83
		Carried over				13.332	2,318	17	32	15	864.37	1460	22	20	126	4	18				9566			1504	365	"
		Carried over																			76059	144		131,232	"	

1964

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| | | |

		Carried forward																													
		Carried forward				55.096	9045	146	432	13	467.924	5372	6	9	1072	2	11	15923	5	2	49270	8	33357	8944	1636							
26		74 Constructing Koraleeara Bridge	2	30	32	J. C. 4.16.0 = 4.800	809	5	15		225.250	422	7	5	60	3	3	1306	15	8	9	4668		3362	760	160							
27		49 contg: Kalluthodu bridge	1	6	7¼	0.6.19 = 0.308	59	8	11	2	45.750	70	7	6	2	13		134	13	5	9	424		290	100	16							
28		53 Do. Culvert 8x9	1	15	17	0.18.86 = 0.938	174	10	5	15	67.130	93	8	5	22	10	6	305	13	4	9	1034		728	224	40							
29		27 Iyapothal Bridge	1	10	11½	0.11.86 = 0.588	100	6	10	6	67.260	61	0	6	10	4		178	14		6	420		242	176	23							
30		69 Valiakamalli-Vadalli	1	28		2-8-0 = 2.400	370	12		18	117.950	226	14	1	37	9	8	652	8	11		2130		1477	420	69							
31		69 Vajarathodu Bridge	1	18		1-2.32 = 1.114	183	3	8		79.090	144	13	1	16	11	4	344	12	1		1239		894	295	40							
		Total				65.244	10,742	2	6	489	3	4054.354	6391	9	9	1222	6	8	18846	5	11		59185	8	40350	10919	1984							

Rail Girder Bridges

2 32		67 Renewing Malagalli Bridge with Iron Rail girders and wooden platforms	14½	16	17 each													187	138	9	900		717	224	40							
33		6 Do. Chethoopalam Bridge	10	12	J. C. 2.2													1364	161	9	1800		035	176	23							
34		61 Do. Kaathodu Bridge	20	22	2 Lines	87	10			89.25	91	6		16			195		9	1421		226	300	44							
35		61 Do. Oorok Do.	22	24	2¼													2094			1505		1296	312	57							
2 36		6 Do. Vazail Thodu Do.	1	20	22	2	181			93.00	97	6	2	41	11	0		320	12	9	1476		456	300	44							
37		83 Vazakapa Bridge	1	13¼	15	16 each	79	8		68.12	74			12				165	8	9	860		6	220	31							
38		83 Do. Voarimalangara Bridge	1	10	12	14	69	8		57.00	61	6		9		4		139	144	9	616			176	23							
39		89 Do. Vembalova Bridge	2	17	19	2½	182			162.50	147		2	41	5	5		370	5	7	9	1245			266	56							
40		75 Do. Mudikathodu Do.	1	20	22	2 Lines	192	15	0	89.25	91	6		16				300	6		9	1411			300	44							
2 41		75 Do. Valagalthodu Do.	1	18	20	1½	108	6		83.00	92	8		6	10			207	8		9	1204			295	40							
42		4 Do. Irdlayaram Do.	1	15½	17½	18 each	116	4		62.00	149	13	10	8	15			275	10		9	982			266	40							
2		Carried over																3735	11	8		13420			2835	436							
		Carried over																94906	4	3		190447	8		10919	1984							

Carried forward

Carried forward

Rails Girders

| | | |

			Carried forward											94906 43		190417 84	9523	10919	1984
			Carried forward											7980 70		31907	2397	765	1148
63		6	constructing 5 26 in 2 vents washed away culvert	1	12	14	60 cs .73	66	44		65.64	89.154	11	75	167	111	9	799	84	652	200	31
64		5	Bridge on Yeroke Pa. over dry west side	1	10	12	.65	72	128		50.24	62 128	1	4	136	134	9	603		466	176	23
65		5	do Pa. East side	1	10	12	.65	62	105		54.61	80 42	1	4	144	27	9	603		459	176	23
66 69		1	conslg 4 bunnels in road Road No. 1 elevated Lg.	4	8	10	2.0	212	710		206.56	312	52	8	576	1510	9	2074		1497	672	64
70		1	Bridge in road No. 1 thro Sirkody Bazaar & embkmt	1	16	18	.86	61	118		60.26	75 52	2	1	139	21	9	1094		950	224	40
71		27	Bridge at 10/1 mile	1	4	6	.41	27	7		30.01	41	2	3	103	72	15	9	347		250	100	11
72		do	do Pa 9/8 mile	1	4	6	.41	27			30.01	41	2	3	103	71	105	9	347		250	100	11
73		24	Muruingolly Bridge	1	17	19	.91	64	710		72.15	129	18	15	212	610	9	1082		950	133	28
74		15	Oopayathodu do	3	17/2 6 3/4	8 6	1.3	64	710		206.30	290	43	17	371	131	9	1165		865	300	33
75		43	Bridge at 10/5 mile	1	15	17	1.68	78	91		59.92	74	144	2	155	85	9	1020		796	224	40
76		48	Bappow Bridge	1	15	17	.84	79	131		58.60	78	4	3	161	131	9	1025		801	224	40
77		do	Poothiarumbatte do	1	7 1/2	9 1/2	.51	57	76		34.76	47	72	3	108	107	9	474		374	100	16
78		5	Bridge at 16/4 mile of road No. 5	3	6	8	.5	17	73		08	55	17	3	75	810	9	402		302	100	11
			Total											10374	136		42942			10386	1519
			Grand Total											105281			233359			21305	3503

Compd 20/6/89 HL

Calicut 20 Novr 1889

M. I. C. E. District Engineer & B Malabar

1961

Statement

B

B Malabar

Statement showing important Bridges to be constructed with Iron Beams. 1964

Name of Bridge.	No of Spans.	Cost according to estimates of design.	Cost according to Secretary of States design.	Difference	Cost of annual upkeep at 4% on years.	Cost of renewing metal covering in 40 years as per Secretary Design.
Plandole.	4 of 80ft.	35,000	52,000	17,000		
			Girders & platforms			
Kottiyoor	20 of 30	20000 R.B.	50,000			
		16,000	16,000	30,000	7,600	1600
		36,000	66,000			
Mooorat.	10 of 30	10000	25000			
		7000	7000	15,000	3800	800
		17000	32,000			
Moache	11 of 30	11,000	27000			
		8,000	8,000	16,000	3895	880.
		19,000	35,000			
Koduvelly	12 of 21.	8000	20000			
		8000	8000	12,000	3,600	528.
		16,000	28,000			
Erinjolly	5 of 30'	5000	12000			
		4000	4000	7,000	1900	400.
		9,000	16,000			
Shaikadu	3 of 25.	1500	2400			
— 9 ft Roadway. —		1000	1000	900	984	171. 8. 0
		2500	3400			
Cheruthoornapuza	4 of 25.	3600	10000			
— 9 ft Roadway. —		1500	1500	6400	1312	228. 10. 8.
		5,100	11,500			
Mangalam	5 of 30'	3,850	11,500	7,650	1,900	400.
— 9' Roadway. —						
Carried over.		143,450	255,400	111,950	24991	5008

1964

Name of Bridge.	No of Spans	Cost according to Anderson's Design.	Cost according to Secretary of State's Design.	Difference	Cost of renewal of platform in 40 years Anderson's Design.	Cost of renewing metal covering in 40 years as per Secretary's Design.
Brought forward.		143,450	255,400	111,950	24,991	5,008
Collengode	5 of 30	3,850 Each Year	11,500	7650	1,900	400
Coombiacode	3 of 30'	2300	6900	4600	1140	240.
Ottapolam	3 of 30'	2,300	6,900	4600	1140	240.
Big Bardur	3 of 30'	2,300	6900	4600	1140	240
Padripoya	1 of 51'	6,000	9000	3,000	—	—
Tirumalythodu —9 ft Roadway	1 of 30	1,000	2500	1,500	380	80
H bridge on the same mile beyond — Thirumalythodu — 9 ft Roadways	2 of 30	2,000 600 2,600	5000 600 5600.	3,000	760	160
Poonoor Bridge	2 of 38.	4000 Rou.	5500	1,500		
Patari wooden Bridge.	3 of 24	2,500	5,100	2,600	954	172.
Kollakat	1 of 17	300	1,000	700	228	40.
Carried over		170,600	316,300	145,700	32,663	6580.

Name of Bridge.	No of Spans.	Cost according to Anderson's Design.	Cost according to Secretary of State's Design.	Difference	Cost of renewals of platform in 40 years Anderson's Design.	Cost of renewing metal covering in 40 years as per Secretary's Design.
Brought forward.		170,600	316,300	145,700	32,663	6,580.
Kollakat No 2.	1 of 16'	300	1,000	700	224	40.
Punjapadam 1	1 of 13½	250	650	400	224	31.
Punjapadam No 2	1 of 10'	200	580	380	176.	29.
Kolathur	3 of 28 2 of 19	2,600	6,500	3,900	1740	284.
Cravelthodu	2 of 20	750	2,800	2,050	600	88.
Cardathodu	1 of 14½	300	946	646	224	40.
Komarthodu	1 of 14½	300	946	646	224	40
Erikalthodu	1 of 14	280	946	666	224	40
Goondipoya	3 of 31 2 of 28½.	3,490	10,600	7,110	1852	377.
Carried over.		179,070	341,268	162,198	38,151.	7,549.

16

Name of Bridge.	No of Spans.	Cost according to Anderson design	Cost according to Secretary of States Design	Difference	Cost of renewals of platform in 40 years Anderson Design.	Cost of renewing metal coming in 40 years as per Secretary design.
Brought forward		179,070	344,268	165,198	38,151	7,549
Nellipoyo	3 Spans 28 27½ & 26½	1,782	5,700	3918	1056	196.
Chooriat	2 of 32¾ and 32¼	1,600	4,700	3,100	920	176.
Mattachenthodu	2 Spans 19¾ 19½	750	2,600	1850	600	88.
Thoopanaad	5 of 27½	3,000	9500	6500	1,760	342.
Thripeethodu	3 of 33½	2,900	7,500	4600	1,580	264
Karnikoya	4 of 60	7,000	10,500	3,500	—	—
Nellikuthu	2 of 28½, 23½.	1,200	3,700	2,500	1,408	137.
Adipoya	2 of 82½	1,700	4100	2,400	920	176.
Kottakal Poothoor	3 of 28¼	1850	5400	3550	1056	264.
Bridge 2 miles north of Palghaut.	60 of 76'	45000 25,000 70,000	102,000	32,000	"	"
Carried over		270,852	496,968	226,116	47,251	9,192

1964

Name of Bridge.	No of Spans.	Cost according to Anderson design	Cost according to Secretary of States Design	Difference	Cost of renewals of platform in 40 years Anderson Design.	Cost of renewing metal coming in 40 years as per Secretary design.
Brought forward.		270,852	496,968	226,116	47,251	9,192
Ammakayam.	5 of 76	37,000 14,000 51,000	64,000 14,000 78,000	27,000		
Pamanaram.	2 of 76	15,000 4,000 19,000	25,600 4,000 29,600	10,600		
Mannamkoddy.	3 of 76.	25,000 12,000 37,000	40,000 12,000 52,000	15,000		
Peruate		22,000	35,000	13,000		
Thermapatam						
Thaulchodu	6 of 24½	4,000 5,600 9,600	10500 5600 16100	6500	1,968	342.
Carticoolam	4 of 25	2,000 2,000 4,000	7,000 2,000 9,000	5,000	1,312	228.
Nellikuthu	2 of 30	2,000 2100 4100 for pile trestles +2 for abuts.	6600 2,100 8,700	4600	920	160.
3 Bridges on Cheramkadayp Road.	20 ft. Span.	12,00	4500	3300	900	132.
Patat Bridge on Road no 24.	1 of 44	5,000	8,000	3,000	—	—
Total		460,752	789,868	329,116	52,351	10,054

Called
20.5.89

M.d.66
District Engineer

C.

Statement shewing the difference Excess, and Savings between the Secretary and Mr. Anderson's designs for Bridges Constructed and to be Constructed in Malabar District.

Particulars	Amount	Total.
Total difference Excess as per Secretary's designs over Mr. Anderson's for Bridges already constructed.	128100 " "	
Add for repairs to flooring for 40 Years as per Secretary's designs	3503 " "	
Total Excess over Mr. Anderson's Estimates.	131603 " "	
Deduct for wood work for 40 years as per Mr. Anderson's designs	21305 " "	
Nett. total Savings as per Mr. Anderson's Design.		110298 " "
Total difference Excess as per Secretary's designs over Mr. Anderson's for Bridges Yet to be constructed.	329116 " "	
Add for repairs to flooring for 40. Years as per Secretary's Design.	10054 " "	
Total Excess over Mr. Anderson's design	339170 " "	
Deduct for wood work for 40 years as per Mr. Anderson's design	52351 " "	
Nett Total Savings as per Mr. Anderson's design		286819 " "
Grand total Savings.		397117 " "

Calicut
20th May 1889

W. Anderson M.I.C.E.
Distruct Engineer.
Dist: Board. Malabar.

1964

Statement C

Abstract.

3/1964 Copy.

Inward No527 Office Note

1964

To,

The President, District Board
Malabar

Encl 4.

1. After a very careful examination of the type drawings, supplied by Secretary of State for Road Bridges, vide G.O 4th June 1888 R & Mis: and 2298 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 Emily and Mevumpoya completed up to date, according to designs prepared by me - entirely outside of office hours - a saving of Rs. 128,000 has been effected compared with cost, if works had been carried out according to the type designs and estimates supplied

20

by Secretary of State.

2 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 lbs. 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 7½ Cwts, and this load may be concentrated on a central length of 6·5 feet of any beam causing equivalent central dead loads, ranging from 4·3 tons on 5 feet spans to 6·75 tons on 82 feet span on any single beam; while the 64 pounder on wrought iron carriage and 7" B.L guns and carriages weigh respectively:-

On two fore wheels	22 Cwts
two hind do	83 "
And two fore wheels	34 "
two hind wheels	78 "

loads such as are adopted only for high-way bridges carrying heaviest

1964

classes of city traffic

6 The Bridges as now designed by me are equal to the following loadings:-

(a) The Iron Trusses. Every day working loads of 80 lbs 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 admissable smaller factor of safety for such temporary or occasional services in case of emergency, we can convey the heaviest classes of artillery viz:- 64 pounder gun carriage and horses, or a crowd of 120 lbs per square foot of roadway and also elephant. All guns heavier than the field 40 pounder viz 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 lbs per square foot, would of course be considered as a dead load; more vibration might be caused by either of these loads, but no oscillation which could

21

only be caused by the whole mass of the load lifting and pitching, could be set up sufficient to warrant them being taken as live loads.

(6) *For all Simple rolled beam (Iron) Bridges* up to 32 feet span, the safe working crowd loading is 120 lbs 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

1964

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 7 8 cwts on slides, the 64 pounder on W.I. carriage or the steam sapper and elephant.

(C) *All Rail Girder Bridges* 5 to 21 feet span will safely carry 180 lbs 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

22

and heavy artillery 64 pounder or the 7" B.L guns in cases of emergency, a pinjple bieste 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. 2000 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 Cwts and 6¾ Cwts per foot run of bridges having respectively 14 and 9 feet roadway. In rail road bridges of such 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

1964

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 lbs per square foot or 9.65 Cwts + ballast 6.75 Cwts, thus making a total of 16.40 Cwts. per foot run, or a difference of 7.40 Cwts in excess of the loads (crowd 100 lbs = 8 Cwts + planking 1 Cwt = total 9 Cwts) 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 lbs for outlying districts like Malabar, ranging up to 100 or 120 lbs in Cities, while for bridges over 100 and up to 200 feet span, the loading ranges

23

from 70 lbs in outlying Districts to 50 lbs 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 lbs 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

1964

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 shewn in the type drawings instead of offering advantages, will only simplify handling to 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,

24

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, repairing or repainting and protecting such works.

12 When, 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

1964

makes one feel that the designer [illegible] 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" x 3") is placed 1" inch 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 anyway,

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 ⅛ of an inch off the jaws of some of the said bed plates. This altho' 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 those 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

15 ft.

1964

Of the old one; and no 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 metab (broken stone) covering for all spans below 80 feet.

(b) The plank roadway for all spans above 40 feet.

87

17 There cannot be two opinions

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.

11th 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.

1964

14 d.

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 120 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.

26

In connection with the same work, a number of bed plates were inserted; 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 1/8 of an inch off the jaws of some of the said bed plates. This altho' 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 those skilled laborers spin the work out; knowing as they do right well - are 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

15 cont.

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.

1964

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 80 feet.

(b) The plank roadway for all spans above 40 feet.

27

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 limber platforms offer the greatest advantages in every way for such a structure as Batala, 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

1964

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 foot) resting on three 6" planks or 1½ feet width of planking at centres 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" planking is really intended to be laid transversely

20

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 subscribed for.

21 Considering 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 5000 lbs 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 pinching money to put up metal that will be lying inert for years;

1964

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 3.27,000 Rs 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 lacs of Rupees on Capital account as per statements A & B. The cost of repairs, allowing 4 renewals of wooden platform in 40 years and a wear of 1" per annum on the metal covering as per Mr. James's 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 lacs of Rupees - see Statement C - Abstract of A & B.

23 As I was the means of calling for these type designs (vide G.O No: 269 of 1st Febry 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 Ponnilly Bridge notified by the Secretary of State in his tender of 24th March 86 vide G.O. No 1065 of 30th August 86, 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.

M. Anderson M. I.C.E.
Asst Engineer D. B.O.
Malabar

Calicut
20th May 1889
WSC

30.

No: 528 Appendix A 1904

Print

1964

Note re crowd and cart loadings for high-way Bridges

a. With reference to Paras 9 & 10 of my office-note no 527 dated 20th May 1903 have to point out that a disorganized and packed crowd will average 150 lbs per man and may cause a load of 120 lbs per square foot of standing room

b. The annexed tables 1 & 2 shew the approximate number of men required to cause loads of 120 and 80 lbs per sq

Table No 1

No. of people required to cause a load of 120 per sq: ft of Roadway

One Span	9ft Roadway	14ft Roadway
	No. of People	No. of People
20 ft.	144	224
30 '	216	336
40 '	288	448
60 '	432	672
80	576	896
100	720	1,110
150	1080	1,660
200	1440	2,220

31

Table No. 2

No. of people required to cause a load of 80 lb per square foot of roadway.

One Span.	9 ft Roadway	14 feet Roadway
	No. of People	No. of People
20 ft	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 2,500 lbs 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 lbs per square foot as shewn in Tables I & II or again wheel loads heavier than the country cart occuring in any part of this District outside the limits of any of our large towns you can easily judge.

M.I.C.E

Distt Engineer Distt Bd Malabar

Calicut
20th May 1889
WSC

1964

Enclosures to

No. 785

25-5-89

No. 785 Malabar District Board Office

Calicut 26th May 1889.

1964

From,

C. CURRENT No. 1994 P.L.

H. M. Winterbotham, Esq: not:

President. District Board

Malabar

To.

The Honble J. H. Price,

Chief Secretary to Government of

Madras.

Sir,

With reference to your endorsement dated 18th

No. 1479. I have the honor to have

forwarded for adoption certain standard

designs furnished by the Secretary of

State for iron-bridges - I will refer to

these hereafter as the Nav Standard-

Plans

2. Mr Anderson, the Board's Engineer

has made the Construction of iron-bridges

a special study, and has shown him-

-self, by the many iron-bridges which

he has designed and erected for this

Board to be an expert Competant

and entitled to criticize even designs

of such high authority.

3. I beg to submit for the Consider-
-ation 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 [illegible] of the designs
[illegible] Board
with a great and quite un-
-necessary increase in the Cost of
Construction.

4. The New Standard Plans pro-
-vide for Carrying a crowd-load
of 120 lbs 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

1964

the following loads:- 2d

Bridges with spans under
40 feet ..... 120 lbs per Sq. foot:
With Spans from 40 to 100 ft .... 80 lbs. Do.
..... 100 to 152 ft .... 70 lbs Do

Each class of bridge to Carry a
wheel-load of 2½ tons, or axle-load of
5 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 these to have put up on the new
Standard Plans would have cost the
Board an additional 1¼ 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 —

36

3.

over 3¼ 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 these 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 Boards 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?

1964

In a chain of 5000 links what is the use of making a few links here and there twice as 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 Culv-
-ert it habitually makes a
detour. Large streams and rivers
it crosses by fording or swimming.

8. The legal advisers of Govt
held ~~that~~ a permanent order
prohibiting the passage of
Elephants over bridges in Mala-
-bar Could not be legally noti-
-fied by Government under Section
144 of the Code of Criminal
Procedure (vide G.O. dated 10th
May 1888 No. 1088.) but I take
think it that × Add end
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 depart-
-ment. 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 floor way (in
place of a timber platform) unn-
-necessarily increasing the weight
of the floor-way and of the material
to support it.

38

6) the use of granite bed-stones with dove-tail sockets, instead of the timber bed-plates hitherto used, and which are adopted - Mr Anderson for small bridges on the rail-ways. In a District like Malabar where small timber is every where 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~~ 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

1964

PROCEEDINGS O

E. MADRAS GOVERNMENT.

PUBLIC WORKS DEPARTMENT.

Under date the

READ the following

From the President Dist. Bd. Malabar
Endorsement thereon with the
Dupto

Recorded with
Consrs Folio No.
Fine 1869

Mr Anderson's Objection to the
necessary cost of bridge built to
Mr James' designs have weight in
light of his own long experience
ork in the S. I. Railway, and in bri
uilding in the Malabar District
but Mr James' views are theoretica
correct, and his assumption of 12
lbs p. sq. ft as the max. load a bridg
may be called upon to bear is additi
the momentum of a moving mass and
allowance to avoid becoming unsafe

1969

4D

Gov. Abbe Morris

Dated

20 July 29 1790

Lyke despatches to Spain

Orders to retain

the President, &c by

Mr Jefferson

— forwarded to

the Secretary of State

Indies