11th October 1890, No. 1507 R., Public Works.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read again the following papers:—

G.O., dated 25th August 1890, No. 1258 R., Public Works.

Telegram from the Engineer-in-Chief, East Coast Railway, Vizagapatam, to the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, dated 12th August 1890.

I request you will sanction manufacture of well-curbs for Kistna bridge in Bombay.

From the Officiating Under-Secretary to the Government of India, Public Works Department (Railway Stores), to the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, dated Simla, 14th August 1890, No. 109 R.S.

I am directed to forward, for the information and consideration of the Government of Madras, copy of a note, dated the 9th August 1890, by Mr. F. L. O'Callaghan, C.I.E., Consulting Engineer to the Government of India for State Railways, recommending that the well-curbs for the Kistna bridge, East Coast Railway, should be made up locally, and urging the substitution of Portland cement concrete for stone work in the wells.

2. I have to request that the note by the Consulting Engineer may be laid before the Engineer-in-Chief of the East Coast Railway for his careful consideration of the views expressed therein.

3. In the event of the Government of Madras deciding to obtain the well-curbs locally, I am to point out that there is no objection to this being done, and I am to invite attention to appendix N to Public Works Department Circular No. XI., Public Works, dated 21st June 1883, in which well-curbs are included in the list of articles which may be manufactured in India.

4. Should the Government of Madras concur in Mr. O'Callaghan's suggestion to use Portland cement concrete in place of stone work for the wells, I am to request that the Government of India may be favoured with an immediate report of the action taken by the Government of Madras so that no time may be lost in transmitting an early telegraphic order to England for the necessary Portland cement in order that the greatest advantage may be taken of the ensuing working season.

Enclosure.

Copy of a note by the Consulting Engineer to the Government of India for State Railways, dated 9th August 1890.

EAST COAST RAILWAY.

Kistna Bridge.

This project is now being gone through by me with Mr. Spring, Executive Engineer, and when the report, which is being printed, is ready, full notes will be sent on it. In the meantime it is most important, in order to save the coming working season, that the well-curbs should be ordered at once. The season in Madras is unusually short owing to the two rainy seasons;

therefore every hour should be availed of. To order the curbs from England is to lose a whole year. As a special case under appendix O, para. 2, Public Works Department Code, Volume I, the curbs can be ordered in India, and the great loss that the delay in procuring them from England certainly justifies this being done.

The design of the curbs is similar to that of the Chenab bridge well-curbs and is, I consider, good and suitable.

In the estimate for the wells the Engineer-in-Chief proposes stone, bricks not being obtainable locally, but I strongly advise that Portland cement concrete may be substituted for stone. The increase in expense, if any, will be very small and will be fully compensated for by the greater strength obtainable in the work which gives extra security in the most uncertain part of the bridge erection.

If this is approved of 20,000 barrels (400 lb. each) should be indented for to be sent to Madras or Cocanada at the rate of 5,000 barrels per month, first delivery to be on or about 1st November.

From the Officiating Under-Secretary to the Government of India, Public Works Department (Railway Construction), to the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, dated Simla, 16th August 1890, No. 726 R. C.

I am directed to ackowledge the receipt of your letter, No. 1035 R., dated 18th July 1890, forwarding the report and estimates for a bridge over the Kistna river at Bezváda, East Coast Railway.

2. With reference to para. 4 thereof, I am to convey the sanction of the Government of India to the collection of stone and other material for the bridge, and to the construction of the necessary staff quarters.

3. As regards the proposal to obtain the iron well-curbs locally, I am to refer you to Public Works Department letter, No. 109 R.S., dated 14th August 1890, in which you were informed that the curbs should be made up locally.

Telegram from the Joint Secretary to Government, Public Works Department, Railway Branch, to the Engineer-in-Chief, East Coast Railway Survey, Waltair, dated 18th August 1890.

Your telegram twelfth regarding manufacture well-curbs Kistna bridge. Similar request received from Spring, Simla, who was told that India's sanction was asked in our letter 1035 R., 18th July, embodied in G.O., 1087 R., 29th July 1890. India's sanction awaited.

Order—dated 25th August 1890, No. 1258 R., Public Works.

Ordered that the following telegram be despatched to the Engineer-in-Chief, East Coast Railway Survey :—

> "India sanctions purchase Kistna bridge well-curbs in India. O'Callaghan suggests use of Portland cement blocks for wells instead of stone and that 20,000 barrels should be ordered from England by wire. Do you wish to use Portland cement blocks and should India be asked by wire to obtain the 20,000 barrels."

2. A copy of these proceedings will be communicated to the Consulting Engineer for Railways with reference to Proceedings, No. 1035 R., dated 18th July 1890, embodied in Proceedings, No. 1087 R., dated 29th July 1890, for transmission to the Engineer-in-Chief, East Coast Railway Survey, for careful consideration.

(True Extract.)

(Signed) T. GRACEY, Lieut.-Colonel, R.E.,
Offg. Joint Secy. to Govt., P.W.D.,
Railway Branch.

Telegram from the Engineer-in-Chief, East Coast Railway, dated 5th September 1890.

Telegram from the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, to the Secretary to the Government of India, Public Works Department, dated Madras, 6th September 1890.

Your No. 109 R.S., 14th August. Walker wires. Begins. Agree use Portland cement Kistna wells. Ask India order three thousand barrels at once by wire. Balance to be ordered similarly as required. Ends.

Read also the following paper :—

From the Secretary to the Government of India, Public Works Department (Railway Construction), to the Joint Secretary to the Government of Madras, Public Works Department, Railway Branch, dated Simla, 9th September 1890, No. 812 R.C.

In continuation of Public Works Department letter, No. 726 R.C., dated 16th August 1890, I am now directed to forward herewith, for information, a copy of a note by the Consulting Engineer to the Government of India for State Railways on the report and estimates received with your letter, No. 1035 R., dated 18th July 1890, for the construction of a bridge over the Kistna river at Bezváda, East Coast Railway.

2. The Government of India concurs in the several recommendations made by the Consulting Engineer for State Railways as summarised in para. 16 of his note, viz.:—

(1) that the site selected *below* the anicut for the bridge should be adopted ;
(2) that the bridge should consist of twelve spans of 300 feet girders ;
(3) that the wells should be as designed ;
(4) that stone pitching be placed round the piers ;
(5) that the gauge should be mixed and with three rails only ; and
(6) that the cartway should be retained.

3. I am accordingly to convey the provisional sanction of the Government of India to the estimate, amounting to Rs. 44,26,000, of the cost of a bridge of 12 spans of 300 feet girders with the necessary approaches and training works.

4. The Government of India is pleased to learn from para. 18 of the Consulting Engineer's note that, in his opinion, great credit is due to Mr. Walker and to Mr. Spring for the manner in which the project for this bridge has been prepared. This commendation should be communicated to these officers.

5. The provisional sanction herein accorded has been registered as No. 1, E.C. Ry. of 1890-91.

Enclosure.

Note by the Consulting Engineer to the Government of India for State Railways, dated 16th August 1890.

I have gone through the project carefully with Mr. Spring, Executive Engineer, who prepared it.

2. I have no doubt whatever that the site below the anicut, where the course of the river is fixed by the two hills flanking the anicut, is the best in every way. The river bed here consists of sand and silt to an unknown depth (borings have been taken to a depth of 110 feet) which is the best for well foundations.

3. The site being settled, the next question to determine is the span of girder to use, and the number of such spans.

4. The spans suggested in the report are 200 feet, 250 feet and 300 feet, and both the Engineer-in-Chief and the Consulting Engineer, Madras, advise the use of the medium span.

5. In the comparison of cost for a given length of bridge the difference in cost between the 200 feet and 300 feet spans amounts to about five lakhs of rupees, but it is shown that the pier used for the 200 feet span comparison was too light, and this seems to me to be the case, and that the true difference would be under four lakhs.

6. But, as Mr. Spring points out, the smaller spans do not give the bridge the same discharging capacity as the larger ones, while the possible danger to the bridge which may be caused by a breach in the anicut varies inversely as some function of the span greater than the simple ratio of length. The larger span also means a less quantity of the most uncertain part of the work, viz., the well sinking, and thus gives a direct gain. For these reasons I strongly recommend that the 300 feet spans be adopted and that the girders be ordered.

7. Regarding the number of spans, I would have no hesitation in recommending ten, if the river was clear of other works, but with the anicut within half a mile in distance on the upstream side, I thought it right to consult Colonel Forbes who is in favour of 12 spans, and this number should, I think, be accepted.

8. For the foundations, in consideration of the great success of Mr. J. R. Bell's hexagonal wells for the Chenab bridge, I do not think any change should be made in the design submitted, which is a slight modification of Mr. Bell's.

9. I cannot recommend the use of two 25 feet wells on the remote chance of the bridge being doubled at some future time. I have taken out the quantities roughly and find that the extra expense would not fall far short of 8 lakhs, a much larger sum than that mentioned by the Madras Government.

10. For building the wells, as bricks are not available, I recommend Portland cement concrete. The cost will be about the same as that estimated for stone and the work will be stronger and of more uniform quality throughout.

11. A design for the 300 feet girders is submitted. This may be sent demi-officially to Sir Alexander Rendel, but it must, I think, be accepted that the Consulting Engineer to the India Office will have the girders designed according to his own ideas. He, however, has more than once asked me to let him know the wishes of Engineers in this country so that he may conform to them if practicable.

12. I have gone through the details of the rates for work to be done in India and I think they are sufficient. The probable cost of the English material it is impossible to forecast at present when such violent fluctuations are taking place in exchange, but a saving under this head seems probable.

13. With regard to the remarks of the Consulting Engineer, Madras, I think it will hardly be safe to omit the stone protection to the piers, but in laying this stone care should be taken to put it in a uniform layer. If this is done there should be little chance of scour extending to a dangerous extent.

14. I cannot agree that the mixed gauge should be laid with four rails. The centre of the bridge and broad gauge track can only differ from the metre gauge by $1\frac{1}{8}$ feet and this difference can scarcely cause a greater difference of deflection than may be caused by wind or other abnormal forces, while to lay four rails instead of three will cause complicated crossings and turnouts which will be a constant source of trouble.

15. With regard to the cartway, the bridge must be decked if for no other reason than for wind bracing and for the use of men working on it. The small extra cost of filling in the corrugations with strips of wood to make it passable for carts should, I think, be incurred even if it can be used but twice a day.

16. The proposal for foot-ways is to utilise the top booms by planking them, and fixing light hand rails, thus giving separate foot-ways for passengers in each direction.

17. To summarise, I recommend that—

(1) the lower site be adopted;
(2) the spans should be 300 feet;
(3) the number of spans be 12;
(4) the wells be as designed;
(5) the wells be built of Portland cement;
(6) stone pitching be placed round the piers;
(7) the gauge should be mixed and with three rails;
(8) the cartway should be retained;
(9) the estimate be sanctioned.

18. I think great credit is due to Mr. Walker and Mr. Spring for the manner in which the project has been prepared.

ORDER—dated 11th October 1890, No. 1507 R., Public Works.

Communicated to the Consulting Engineer for Railways with reference to Proceedings, No. 1258 R., dated 25th August 1890.

2. Para. 4 of the letter from the Government of India read above will be communicated to the officers concerned.

3. This sanction has been registered as No. 17 R. of 1890-91.

(True Extract.)

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

To the Consulting Engineer for Railways.
„ the Examiner, Public Works Accounts.
„ F. B. Walker, Esq.
„ F. J. E. Spring, Esq.

Exd. A. Aubert.
Spare Copies

RAILWAY.

Govt. of {1890} Madras

PUBLIC WORKS.

Dated October, 11th.

Recd. *Encl.*

G.O., 11th Oct. 1890, No. 1507 R.

OCTOBER.

Bridge over the Kistna River, East Coast Railway

Letter from the Government of India conveying provisional sanction to estimate of Rs. 44,26,000, the cost of constructing the —, and commending Messrs. Walker and Spring for the manner in which the project for the bridge has been prepared, communicated to the Consulting Engineer for Railways.

Read from Ry. filing papers —
G.O. 20th Aug. 90 No. 1255 R. Pub. Wks. 1P

Class Cl H

INDIAN TELGRAPH.

Local No.

To (Station) Ootacamund
Frm (Station) Vizagapatam

Words.	Day.	Hour.	Minute.	Official Instructions,
23.	12.	19	46	defd.

To (Person) Works. Ry.
Frm (Person) En. C. E. Co. Ry.

I request you will sanction manufacture of Well Curbs for Kistna bridge in Bombay

Recd. from	L. N.	Sent to	L. N.
At Hrs.	Mts., By	At Hrs.	Mts., By

Date

Telegraph Master.

OOTACAMUND 13-8-90

P.W.C. No. 7694

RATES OF CHARGE FOR INLAND TELEGRAMS

The address (including name of Sender and name and residence of Addressee) is transmitted free.

	First 8 words	Each additional word,
Deferred Message	... 8 Annas	... 1 Anna.
Ordinary ..	... 1 Rupee	... 2 Annas.
Urgent .	... 2 Rupees	... 4 Annas.

A group of 3, or less figures, is reckoned as one word.

No charge for delivery within a distance of [illegible] miles.

Read ~~12-VIII-90~~
15-8-90.

No. 169 R.S

All communications
should be addressed
to the Secretary.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY Stores.

To

The Joint Secretary to the Government of Madras

(Railway Branch) Public Works Department

Simla, the 14th August 1890.

Sir,

I am directed to forward for the information and consideration of the Government of Madras copy of a note dated the 9th August 1890 by Mr F. L. O'Callaghan C.I.E. Consulting Engineer to the Government of India for State Railways recommending that the Well-curbs for the Kistna Bridge East Coast Railway should be made up locally and urging the substitution of Portland Cement concrete for stone work in the wells.

2. I have to request that the note by the Consulting Engineer may be laid before

the

the Engineer in Chief of the East Coast Railway for his careful consideration of the views + expressed therein.

3. In the event of the Government of Madras deciding to obtain the well curbs locally I am to point out that there is no objection to this being done and I am to invite attention to Appendix N to Public Works Department Circular No XI P.W dated 21st June 1883 in which well curbs are included in the list of articles which may be manufactured in India.

4. Should the Government of Madras concur in Mr O'Callaghan's suggestion to use Portland Cement concrete in place of stone work for the wells, I am to request that the Government of India may be favoured with an immediate report of the action taken by the Government of Madras so that no time may be lost in transmitting an early telegraphic order to England for the necessary Portland Cement in order that

the

31

the greatest advantage may be taken of the ensuing working season.

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

F. B. Hebbert

Offg: Under Secretary.

Hem 14/8/90

Document accompanying
Copy of Consulting Engineer's
note referred to

P. Bco. 2060 W of 27-7-83

PW. Cdo. 7873

Rd 11-8-90
Encl

11-10-90 1507

0/22/8 Ahm. 23/8 R25/8

Print

Copy of a note by the Consulting Engineer to the Government of India for State Railways dated 9th August 1890.

East Coast Railway
Kistna Bridge

This project is now being gone through by me with Mr Spring Executive Engineer and when the report, which is being printed, is ready. full notes will be sent on it. In the mean time it is most important, in order to save the coming working season, that the well curbs should be ordered at once. The season in Madras is unusually short owing to the two rainy seasons therefore every hour should be availed of. To order the curbs from England is to lose a whole year. as a special case under Appendix C paragraph 2 Public Works Department Code Volume I the curbs can be ordered in India and the great loss that the delay in procuring them from England certainly justifies this being done.

The design of the curbs is similar

similar to that of the Chenab Bridge well curbs and is I consider good and suitable

In the estimate for the wells the Engineer in Chief proposes stone, bricks not being obtainable locally, but I strongly advise that Portland Cement concrete may be substituted for stone. The increase in expense, if any, will be very small and will be fully compensated for by the greater strength obtainable in the work which gives extra security in the most uncertain part of the bridge erection.

If this is approved of 20,000 barrels (400 lbs each) should be indented for to be sent to Madras or Coconada at the rate of 5000 barrels per month. 1st delivery to be on or about 1st November.

Pw Incl 7873/90

Accn 14/8/90

5.D

No. 726 R. C.

All communications should be addressed to the Secretary.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY Construction

To

The Joint Secretary to the
Government of Madras
(Railway Branch),
Public Works Department.

ROGS 22/8/90

papers complete [illegible]

Simla, the 16th August 1890.

Sir,

I am directed to acknowledge the receipt of your letter No. 1035 R. dated 18th July 1890, forwarding the Report and estimates for a bridge over the Kistna river at Bezvada East Coast Railway.

Sent to [illegible] on the 25-7-90.

2. With reference to paragrap 4 thereof I am to convey the sanction of the Government of India to the collection of stone and other material for the Bridge, and to the construction of the necessary staff quarters.

P.W. Cir. 7916

3. As regards the proposal to obtain the iron well curbs locally, I am to refer you to Public Works Department letter No. 109 R.S., dated 14th August 1890, in which you were informed that the curbs should be made up locally.

+ Cir 7873 sent to Dy on the 22/8/90

I have the honour to be,
Sir,
Your most obedient Servant,

Rd 22-8-90

F. W. Hebbert

Offg: Under Secretary.

Documents accompanying
Nil

W.P.

0/22/8

Ap. 22/8

TELEGRAM ~~Urgent~~/Deferred,

6 R

From

R.

To

Engineer-in-Chief
East-Coast Ry Sy
Waltair

Your telegram twelfth regarding manufacture well curbs Kistna bridge. Similar request received from Spring Simla who was told that India's sanction was asked in our letter 1035 R 18 July embodied in G.O. 1087 R 29 July 90. India's sanction awaited.

Telegram desp'd 18-8-90

Uz
18/8

Print

⑦

Not to print

TELEGRAM ~~URGENT~~ ~~ORDINARY~~ DEFERRED

FROM R.

To East Coast Survey

India sanctions Buchanan Western Indies well Curbs in India ~~[illegible]~~ O'Callaghan suggests use of Portland cement blocks for wells instead of stone and suggests that 20,000 barrels should be ordered from England by wire ~~at once~~ – Do you wish to use Portland cement blocks as suggested and should India be ~~[illegible] to~~ asked by wire to obtain the 20,000 barrels as suggested –

25/8/90

Please issue above telegram and send on the [illegible] of the letters in clear Cover to-day

25/8/90

Telegram desp'd 25.8.90

From [illegible] / B. — Print No. 1258 R

issue [illegible]

PUBLIC WORKS DEPARTMENT,
RAILWAY BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 25th Aug/90

READ the following

Print
Telegram from the Engr.-in-Chief East Coast Ry Sy. } A.E. No —— of 12th August 1890

Print
Letter from the Govt. of India P.W. Deptt. } " — " 109 R.S. of 14th — do —

Print
Do. — Do. — " — " 726 R.C. of 16th — do —

Print
Telegram to the Engr.-in-Chief E C Ry Sy. } " — " —— of 18th — do —

Print

8 P

Ordered that the following telegram be despatched to the Engineer-in-Chief East Coast Railway Survey:

"India sanctions purchase Kistna bridge well curbs in India x O'Callaghan suggests use of Portland cement blocks for wells instead of stone and ~~suggests~~ O'C that 20,000 barrels should be ordered from England by wire x Do you wish to use Portland cement blocks ~~as suggested~~ [illegible] and should India be asked by wire to obtain the 20,000 barrels ~~as suggested~~ [illegible]"

Telegram despd 25-8-90

2

2. A copy of these Progs: will be communicated to the Consg: Engr: for Rys: with reference to Progs. No. 1035 R dated 18 July 1890 embodied in Progs: No. 1087 R dated 29 July 1890 for transmission to the Engineer-in-Chief, East Coast Railway Survey for careful consideration.

Spring
Offg: R

25/8

B.

No. 1258 R of 25 Augt/90

To The Consg Engr for Rys
" Exr P. W. Accounts

Despatched by Dely office
28/8/90

INDIAN TELEGRAPHS. Monthly Number. 249

Code Class.	DS
To (Office)	Ootacamund
From (Office)	Simla
Words.	39
Day.	5
Hour.	14
Minute.	58
Official Instructions.	D/d
To (Person)	works Ry
From (Person)	En C East Coast Railway

I quite agree to
use of portland cement 9 8 D
for Kistna wells ask
india to order three
thousand barrels at once
by wire the balance
to be ordered similarly
as required

84 Word Form.

Papers

6/9/90

6/9

Recd. from I.X. At Hrs. Mts. by

Sent to I.X. At Hrs. Mts. by

Telegraph Master.

OOTACAMUND 5-9-90

G. W. Allen and Co.—No. 179 T.—8-2-90—20,00,000

Rds 248

2. ~~22~~ A copy of these Progs:

Rds 248 P.W.C. No. 9699

~~22~~

~~Recd 6-IX-90~~

10-10-90

Obs 5-IX

Desptd by Dely office
26/8/90

Print

TELEGRAM ~~Urgent~~ ~~Ordinary~~ Deferred

FROM | To | 10 R
R. | Works India

Your No. 109 R.S 14th August - Walker wires begins Agree use Portland Cement Kistna wells ask India order three thousand barrels at once by wire. Balance to be ordered similarly as required ends -

6/9/90

Telegram desptd 6/9/90

Print

Read also the following paper:—

110

No. 812 R. C.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY CONSTRUCTION.

Ch
20/9/90

To

THE JOINT SECRETARY TO THE GOVERNMENT OF MADRAS,
PUBLIC WORKS DEPARTMENT, (RAILWAY BRANCH).

Simla, the 9th September 1890.

SIR,

In continuation of Public Works Department letter No. 726 R. C., dated 16th August 1890, I am now directed to forward herewith, for information, a copy of a Note by the Consulting Engineer to the Government of India for State Railways on the Report and Estimates, received with your letter No. 1035 R., dated 18th July 1890, for the construction of a bridge over the Kistna river at Bezvada, East Coast Railway.

2. The Government of India concurs in the several recommendations made by the Consulting Engineer for State Railways as summarised in paragraph 16 of his Note, *viz.*:—

(1) that the site selected *below* the anicut for the bridge should be adopted;
(2) that the bridge should consist of twelve spans of 300 feet girders;
(3) that the wells should be as designed;
(4) that stone pitching be placed round the piers;
(5) that the gauge should be mixed and with three rails only; and
(6) that the cartway should be retained.

3. I am accordingly to convey the provisional sanction of the Government of India to the estimate amounting to Rs. 44,26,000 of the cost of a bridge of 12 spans of 300 feet girders with the necessary approaches and training works.

4. The Government of India is pleased to learn from paragraph 18 of the Consulting Engineer's Note that in his opinion great credit is due to Mr. Walker and to Mr. Spring for the manner in which the project for this bridge has been prepared. This commendation should be communicated to these officers.

5. The provisional sanction herein accorded has been registered as No. 1. E. C. Ry. of 1890-91.

I have the honour to be,
SIR,
Your most obedient Servant,

Colonel, R.E.,
Secy. to the Govt. of India.

Sd/
19-9-90

Document accompanying.

Copy of Note by the Consulting Engineer for State Railways, dated 16th August 1890.

36 S.C.

G. C. Press, Simla.—No. 994 P. W. D.—11-9-90,—100.

P. Wks: 913 of

S-C- notread

Recd 26.9.90

Print

1258

Note by the Consulting Engineer to the Government of India for State Railways, dated 16th August 1890.

I have gone through the project carefully with Mr. Spring, Executive Engineer, who prepared it.

2. I have no doubt whatever that the site below the anicut, where the course of the river is fixed by the two hills flanking the anicut, is the best in every way. The river bed here consists of sand and silt to an unknown depth (borings have been taken to a depth of 110 feet) which is the best for well foundations.

3. The site being settled the next question to determine is the span of girder to use, and the number of such spans.

4. The spans suggested in the report are 200 feet, 250 feet and 300 feet, and both the Engineer-in-Chief and the Consulting Engineer, Madras, advise the use of the medium span.

5. In the comparison of cost for a given length of bridge the difference in cost between the 200 feet and 300 feet spans amounts to about five lakhs of rupees, but it is shown that the pier used for the 200 feet span comparison was too light, and this seems to me to be the case, and that the true difference would be under four lakhs.

6. But, as Mr. Spring points out, the smaller spans do not give the bridge the same discharging capacity as the larger ones, while the possible danger to the bridge which may be caused by a breach in the anicut varies inversely as some function of the span greater than the simple ratio of length. The larger span also means a less quantity of the most uncertain part of the work, *viz.*, the well sinking, and thus gives a direct gain. For these reasons I strongly recommend that the 300 feet spans be adopted and that the girders be ordered.

7. Regarding the number of spans, I would have no hesitation in recommending ten, if the river was clear of other works, but with the anicut within half a mile in distance on the upstream side, I thought it right to consult Colonel Forbes who is in favor of 12 spans and this number should, I think, be accepted.

8. For the foundations, in consideration of the great success of Mr. J. R. Bells' hexagonal wells for the Chenab bridge, I do not think any change should be made in the design submitted which is a slight modification of Mr. Bells.

9. I cannot recommend the use of two 25 feet wells on the remote chance of the bridge being doubled at some future time. I have taken out the quantities roughly and find that the extra expense would not fall far short of 8 lakhs, a much larger sum than that mentioned by the Madras Government.

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12. I have gone through the details of the rates for work to be done in India and I think they are sufficient. The probable cost of the English material it is impossible to forecast at present when such violent fluctuations are taking place in exchange, but a saving under this head seems probable.

13. With regard to the remarks of the Consulting Engineer, Madras, I think it will hardly be safe to omit the stone protection to the piers, but in laying this stone care should be taken to put it in a uniform layer. If this is done there should be little chance of scour extending to a dangerous extent.

14. I cannot agree that the mixed gauge should be laid with four rails. The centre of the bridge and broad gauge track, can only differ from the metre gauge by $1\frac{1}{8}$ feet and this difference can scarcely cause a greater difference of deflection than may be caused by wind or other abnormal forces, while to lay four rails instead of three will cause complicated crossings and turnouts which will be a constant source of trouble.

15. With regard to the cart way the bridge must be decked if for no other reason than for wind bracing and for the use of men working on it. The small extra cost of filling in the corrugations with strips of wood to make it passable for carts should, I think, be incurred even if it can be used but twice a day.

16. The proposal for foot-ways is to utilise the top booms by planking them, and fixing light hand rails, thus giving separate foot-ways for passengers in each direction.

17. To summarise I recommend that—

(1) the lower site be adopted;
(2) the spans should be 300 feet;
(3) the number of spans be 12;
(4) the wells be as designed;
(5) the wells be built of Portland cement;
(6) stone pitching be placed round the piers;
(7) the gauge should be mixed and with three rails;
(8) the cartway should be retained;
(9) the estimate be sanctioned.

18. I think great credit is due to Mr. Walker and Mr. Spring for the manner in which the project has been prepared.

G. C. Press, Simla,—No. 904 P. W. D.—11-9-90—100.

A

No. 1507 R d/ 11th Octr/90.

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

READ again the following

Progs: of the Madras Govt: P. W. Deptt:— } M.G. No. 1258 R d/ 25 Augt. 1890
Telegram from Exp. in Ch: E. C. Ry .... d/ 5th Septr: 1890
— do — to Govt: of India P.W.D. .... d/ 6th — do
~~do from Exp in Ch: E. C. Ry~~ .... ~~d/ 7th do~~
~~do to Govt. of India P.W.D.~~ .... ~~d/ 9th do~~
~~do from Exp. in Ch: E. C. Ry~~ .... ~~d/ 11th do~~
~~do to do~~ .... ~~d/ 12th do~~

Read also the following:—

Letter from the Govt. of India P. W. Deptt:— } M.G. No. 812 R. C d/ 9th Septr: 1890

13 P

Communicated to the Consulting Engineer for Railways with reference to Progs. No. 1258 R dated 25th August 1890.

2. Para 4 of the letter from the Govt: of India read above will be communicated to the Officers concerned.

3. This sanction has been registered as No. 17 R of 1890-91

(Sd.)
Sec: R

24 S
22/9/90

To
The Consg: Engr for Rys ✓
— „ — Examr P. W. Accts: ✓
F. B. Walker Esq. ✓
F. J. E. Spring Esq.

18/10

A

No. 1507 R 11th Oct/90.

To await the arrival from Lon.

Very urgent

Print soon

H.M. 2/9 R 28/9

14

9130.

Govt. of (18) Madras.

PUBLIC WORKS.

15/10/90

Dated

Emy Wright

11/10/90

Recd. Encl.

G.O., 11th Octr. 1890. No. 1507R.

Bridge over the Kistna River
East Coast Railway

Letter from the Govt conveying provisional sanction to estimate of Rs 44,26,000, the cost of constg the — & commending Messrs Walker & Spring for the manner in which the project for the bridge has been prepared; commund to the C.E. for Rys —

G.C. 11/10/90
7