(1) பக்கங்களின் எண்ணிக்கை 74

(2) புதுக்கித் திருப்பிய நாள் 12/8

(3) ஆதாரங்குறிப்பவர் சுருக்கொப்பம்

தமிழ்நாடு ஆவணக் காப்பகம்.

தமிழ்நாடு அரசு

P.W.D துறை

அரசாணை எண். 1492 அச்சகம்
மு. கோப்புத் தாள் எண். பலவகை

நாள் : 2.5.1893 198

மடிக்கவோ கண்டபடி கையாளவோ கூடாது

37 sheets.

ஆவண. கா-1—18,000—15-6-87.

1192/1

GOVERNMENT OF MADRAS.

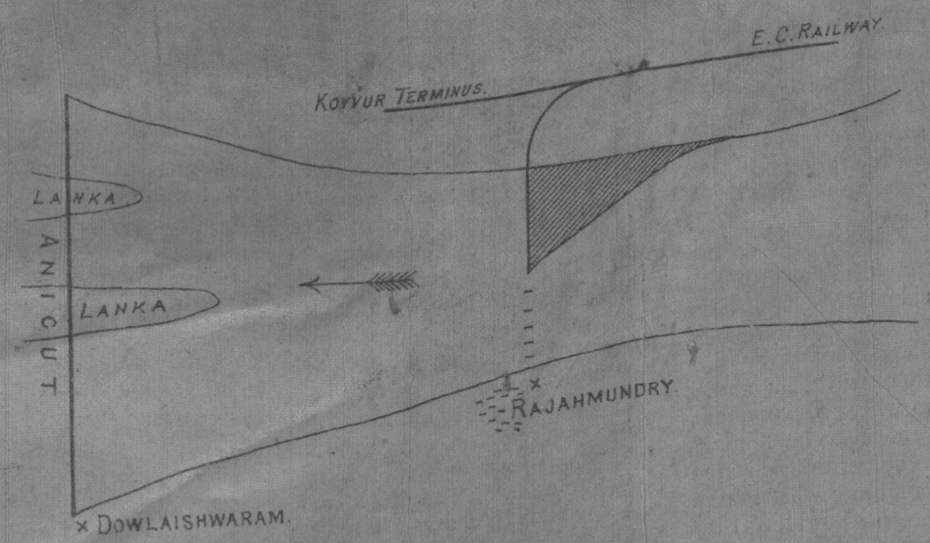
PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers :—

Minute by the Hon. Mr. J. H. GARSTIN, C.S.I., dated 28th March 1893.

Having had the advantage of visiting Bezwada and Rajahmundry with His Excellency the Governor on the occasion of his opening the Kistna bridge to railway traffic, I have had the opportunity of seeing the site where Mr. Spring, the Engineer-in-Chief of the East Coast Railway and the constructor of the aforesaid bridge, proposes to bridge the Gódávari, and of considering whether that is the best possible site for the bridge and also whether the plan of construction is not open to serious objections. I subjoin a small diagram which will serve to illustrate the remarks which follow :—



Mr. Spring's plan is to build the Gódávari Railway bridge opposite Rajahmundry (where the river is about 2 miles wide) and about 5 miles *above* the great Gódávari anicut which crosses the river at Dowlaishweram, where its width from bank to bank is just 4 miles. Rajahmundry and Dowlaishweram are both on the north or left bank

of the river. Mr. Spring proposes to throw out a strong embankment from the right bank of the river for about a mile and thus to reduce the size of the water-way of the river, opposite Rajahmundry, by one-half and to bridge the other half. This project is estimated to cost about 50 or 60 lakhs of rupees, but its construction has been postponed for the present by the Government of India on financial grounds. I take it for granted that Mr. Spring's plan is perfectly feasible and (putting all other considerations on one side) the cheapest way of bridging the Gódávari. But there is this vast difference between the proposed bridge over the Gódávari and that so successfully built over the Kistna, that while the latter is built about ¾ of a mile *below* the Kistna anicut and does not, and probably never will, in any way, affect it or the great system of irrigation dependent on it, the Gódávari bridge is proposed to be built *above* the Gódávari anicut, and we are bound to consider most carefully what its effect, if so built, would be on that work and the still larger system of irrigation dependent thereon. It does not require one to be Engineer to see that one effect of narrowing the river-bed to one-half of its natural size will be to force the whole river to discharge itself with increased velocity through the opening left for it. I do not propose to calculate what that velocity would be at varying heights of flood-level, as it is quite sufficient for my purpose to take a flood-level of 15 feet above that of the anicut-crest, which, I presume, may also be taken to mean a similar rise above the ordinary bed of the river 5 miles above the anicut where the bridge is proposed to be built. Such a level is 2 feet less than an actually recorded rise of the river within the last few years, so it cannot be regarded as extravagant, and it means that when a flood 15 feet above the ordinary average bed of the river is rushing past Rajahmundry (where the river is 2 miles wide) at a velocity of 6 miles an hour (which is, I believe, nothing unusual in times of flood), the sectional discharge of the river is $1{,}760 \times 2 \times 3 \times 15 = 158{,}400$ square feet, which, multiplied by the velocity, is $158{,}400 \times 8{\cdot}8 = 1{,}393{,}920$ cubic feet per second, and the effect of forcing this flow through an aperture of about half the size nature has provided for it would be to increase the velocity of the rush of water through the confined channel and to scour the bed of the river, where it is proposed to be spanned by the bridge, to a considerable depth. The sand and silt thus scoured out would be carried down the river and would either form new islands between the proposed bridge and the anicut, or considerably increase those already existing, or else it would all be carried off over the anicut and down the various irrigation channels leading from it. Of course, so long as the matter in suspension passed over the anicut no harm would be done, but any additional deposit of sand or silt in the irrigation channels themselves or above the head sluices leading to them would be a serious matter involving not only a large increase of expenditure on keeping the sluices and channels clear and a consequent diminution of the profits of the whole system of irrigation, but also tending seriously to obstruct and possibly so to diminish the flow of water for irrigation and navigation. The formation of new islands in the river above the anicut or an increase in the size of any of those now existing might also injuriously affect the set of the river in respect of the various channels. But apart from the interests of the anicut and its irrigation, those of the inhabitants of the town of Rajahmundry must not be overlooked. This town lies within a short distance of the river bank and to the east and on the down-stream side of the site of the proposed bridge, and it seems to me to be a matter of extreme probability that, if the waterway of the river is reduced to one-half just above Rajahmundry by means of an embankment projected from the opposite bank, there will be a strong set or swirl of water on the bank of the river just opposite to where Rajahmundry is situated, and that unless the river bank is here strongly protected, Rajahmundry may be washed away. I base this idea on the evidence afforded by the state of affairs at the north end of the anicut itself. Here we see in miniature what might, I believe, result on a grand scale just below the site of the proposed bridge if it was built as proposed by Mr. Spring. At the north end of the anicut is a row of under-sluices, the object of which is, I believe, to carry off the silt or sand which would otherwise deposit itself in front of the gates of the adjacent lock and head-sluice, and the effect of the comparatively trivial rush of water at a high velocity through these sluices, as well as, perhaps, of the swirl or back-wash caused by the rush of water over the adjoining end of the anicut, has worked a great hole, some

50 feet deep, just below the under-sluices and cut a considerable piece out of the river bank. This hole the anicut officers are trying to fill up with rubble stone, but the task does not seem to be an easy one. Now, if such a result follows at a point where the river is at its widest, and where the forces at work are small, what would be the result if the swirl or set of the river on a particular point of the river bank was as great as it probably would be by the results of Mr. Spring's proposed scheme? To me it seems probable that if the anicut under-sluices at Dowlaishweram were swept away in a flood the swirl of the river through the gap would in a few hours cut right through the river bank and destroy the main canal behind it, and if this was likely to result from such a catastrophe or the destruction of a comparatively small work like the under-sluices, then the result from a flood 15 or 16 feet deep swirling against the river bank at Rajahmundry though the opening left for the bridge would probably be the cutting away of the river-bank between Rajahmundry and the river and the destruction of the town itself, unless the bank was strongly revetted and protected by pitching, but if the river scooped a hole 60 or 100 feet deep in a few hours pitching would be of little use to prevent the undermining of the bank. That there are such holes worked by the current in the river-bed is beyond question. It seems to me, therefore, to be a matter of imperative necessity that before the bridge is permitted to be built, where and as Mr. Spring suggests, we should ascertain from actual experiment what will be the results of confining the waterway of the river to one-half of its present size by an embankment, such as Mr. Spring proposes. The Government of India have, I believe, sanctioned the establishment of a steam-ferry to carry railway carriages and waggons across the river, and if Mr. Spring's embankment was made and the railway brought to its extremity, the ferry could work across the one mile gap with greater facility and more rapidly than if it had to follow the route of the present ferry. Then, if the results of constructing the embankment were not found to be mischievous, Mr. Spring's plan might be carried out in its entirety, but if the reverse proved to be the case, the plan might be modified, before it was too late, either by cutting a large gap in the embankment and bridging it over, thus leaving increased waterway, or by building the bridge below the anicut, the site opposite Rajahmundry being given up and the embankment being demolished. The building of the bridge below the anicut might involve more embankment and possibly more actual bridging than in the present proposed plan, besides involving the bridging of the main irrigation canal near Dowlaishweram, but this would be better than building the bridge opposite Rajahmundry only to find that its construction had resulted in serious damage either to the irrigation system of the Gódávari delta or to the town of Rajahmundry or to both.

(Signed) J. H. GARSTIN.

Note by the Chief Engineer, Public Works Department.

With reference to the Minute, dated 28th March 1893, of the Honorable Mr. Garstin on the proposed railway bridge over the Gódávari river, I have the honour to offer the following remarks.

2. The correspondence * herewith will show that the matter has already received my attention.

3. I had accepted as final the decision of the railway experts, including the Consulting Engineer for Railways (Colonel C. J. Smith) and the Director-General (Sir Guilford Molesworth), that the difficulties and cost of taking the railway below the anicut were prohibitive, though of course I would, from an irrigation point of view, much prefer that the bridge, or bridges as they would have to be, should be built below the anicut where there could be no possibility of injury to irrigation interests.

* Letter (D.O.) from Mr. Spring, dated 14th July 1891.
Reply (D.O.) to Mr. Spring, dated 20th July 1891.
Letter (D.O.) from Mr. Spring, dated 23rd July 1891.
Letter (D.O.) from Mr. Spring, dated 25th July 1891.
Reply (D.O.) to Mr. Spring, dated 1st August 1891.
Letter (D.O.) from Mr. Spring, dated 6th August 1891.
Reply (D.O.) to Mr. Spring, dated 17th August 1891.

4. There had been conversation between the Consulting Engineer and myself, or demi-official correspondence of which I have no copy, about the present proposal, and then the correspondence referred to in paragraph 2 took place.

5. It will be seen from the section herewith (sent to me by Mr. Spring with his letter of 25th July 1891) that though it was proposed to run an embankment across about $\frac{1}{11}$th of the breadth of the river, the discharging *area* at high flood level which would be closed would be not much more than one-third, because where the embankment is to be placed the river bed is high as compared with what it is under the bridge openings; in high floods also the proportion which the "obstructed" would bear to the "free" area would be even less, because at such times much of the sand overlying * the rock and clay near the left bank (where the "set" of the river *now* is and its velocity greatest) is swept away, whilst over the high portion of the bed where the embankment is proposed, the velocity is so much less that the bed does not scour out to anything like the same extent.

* See section.

6. Thus the portion of the river to be left free for discharge under the proposed bridge *now* passes much more than half the total discharge of the river, and it would not therefore, under the new conditions, be called on to perform anything like double the duty which it already performs.

7. But though the extra quantity which will have to pass the section of the river to be spanned by the bridge will not be anything like 100 per cent. more than now passes that way, it will be considerable and will require an extra mean velocity at the place; that velocity need not, however, be alarming or in any way comparable with the state of affairs at the anicut under sluices which the Honorable Mr. Garstin refers to; through them the water is discharged in a boiling torrent, often a cataract falling *many feet* from the water level above the anicut to that below it; at the bridge the water, led on to the bridge by training works, would glide through it with a current which though rapid is not greater than is now seen in parts of the river. Mr. Spring took the probable velocity to be 5 miles an hour or 7·3 feet per second, and I see no reason to expect that it would be greater.†

† 23 spans × 200′ (afterwards increased to 19 of 250′) =	Running feet. 4,600
	Sq. ft.
4,600′ × 25′·6 depth from high flood level to summer level	117,820
4,600 × 12′, extra depth below summer level (*already* portion of the bed at the place is much lower than 12′ below summer level) ..	55,200
	173,020

1,210,000 c. ft. per second, the discharge originally assumed, ÷ 173,020 = 7 feet velocity per second.

8. That even this velocity wherever it occurs will scour out the sandy bed to a considerable depth is certain, and the result will be a probably permanent deepening of the bed at the bridge site. It seems to be thought that the extra velocity caused by the bridge works will affect the river bed over great distances and cause a much greater *general* travelling down of its sand than is now the case; but this will not be so; the extra velocity will probably not come in to play for any considerable distance above the bridge and will certainly disappear at a very short distance below it, so that the extra amount of sand that will be removed from the place is not likely to be of serious moment.

9. No doubt the disposition of the shoals and islands, which even now is constantly altering, will be affected by the railway embankment. It passes the wit of man to predict exactly what will occur; Mr. Spring thinks his proposed works will "result ‡ in a tolerably permanent contour of river bed between the bridge and anicut," whilst I do *not* think so but see no reason to suppose that the ever varying shoals and sand banks will become "worse" § if he carries out his proposals, and I see no reason to fear that any appreciable extra quantity of sand is likely to be carried to the canals.

‡ See his letter, 25th July 1891.

§ See my letter, 1st August 1891.

10. Passing now from the consideration of the effect of the proposed bridge works on the *bed* of the river and on the irrigation works to that of the effect on the left *bank* near Rajahmundry, it will be seen that in my demi-officials to Mr. Spring I drew attention to the absolute necessity for "very thorough protection" of the bank for some distance above Rajahmundry where the "set" of the river which already existed will be intensified, and I spoke strongly on the subject to the then Consulting Engineer for Railways.

11. *Below* the bridge the margin of the river is, I believe, for some distance rocky, and as the stream will almost immediately after passing the bridge be free to spread out to its former width, it is not probable that increased velocity of moment will there exist. It is possible however that at first and till the river at the place accommodates itself to the new conditions, there may be a "swirl" at the place, and if the margin of the river there is *not* rocky, artificial protection should be provided which will prevent its being eroded or undermined.

12. As regards the Honorable Mr. Garstin's proposal to construct the embankment and try its effect for some time before building the bridge, it must be remembered that if this be done the intended costly "training" works which are to "lead" the river quietly on to and away from its restricted channel must also be carried out; it would never do to let the embankment jut out into the river by itself at right angles to the stream, causing a mighty swirl round its end; the protective works referred to in paragraphs 10 and 11 of this note would also have first to be provided, and the experiment would probably render the construction of the bridge piers more difficult and costly than would be the case now, when many of them could be founded on wells sunk through the sand, as at the Kistna.

13. In the marginal note of paragraph 7 of this note the maximum discharge of the river is taken as 1,210,000 cubic feet per second, as that was accepted when the correspondence took place; but subsequently a higher flood than before known and recalculations convinced me that the maximum discharge of the river was not less than 1,500,000 cubic feet per second and I at once so informed the Consulting Engineer for Railways. Mr. Spring, influenced no doubt by a desire to keep down the size of the bridge, demurred, and the correspondence given in Proceedings of the Madras Government No. 3112 R., dated 29th December 1892, took place. As in calculations such as there dealt with co-efficients have to be used which are to some extent matters of opinion and as in a river such as the Gódávari of greatly varying depths and section, the mean velocity cannot be determined with any certainty, it is impossible to assert that the result arrived at by us is absolutely correct and no other, but I feel convinced, as does Colonel Drake-Brockman, that it is not excessive, and it would be but right to increase the proposed clear opening under the bridge accordingly.

14. I would also draw attention to the portion of the correspondence referred to, stipulating for a clear head-way of at least 11·4 feet above the *highest flood level*; it is to be hoped that the level to which the maximum flood of October 1891 rose at the place was observed and recorded.

(Signed) G. T. WALCH,
Chief Engineer, P.W.D.

3rd April 1893.

Minute by the Hon. Mr. J. H. GARSTIN, C.S.I., dated 6th April 1893.

I fully intended, when I wrote my first minute, that if the embankment from the west side of the Gódávari was constructed experimentally, the training works in connection with it, contemplated by Mr. Spring, should also be erected. I quite see how dangerous it would be to attempt to build the embankment without those works. But the Chief Engineer's note does not show that if the embankment and training works *are* constructed, any worse effect will follow than an increase in the difficulty of building the piers of the bridge. This difficulty would probably arise from a deepening of the river-bed caused by increased scour. Mr. Spring, in his demi-official letters of July 14th and 23rd, 1892, calculated the cost of the embankment and training works to be $5\frac{1}{4}$ lakhs of rupees, and the effect of these (by confining

the river and increasing the scour) to be the deepening of the bed of the river under the bridge from an average of 31 to one of 37 feet, or by only 6 feet. I think that it would be 5¼ lakhs well spent to ascertain that these surmises are correct and reliable. If they prove to be so, the deepening of the river-bed by 6 feet will be a small matter to Mr. Spring, while it will be a great thing to have five years' experience, or perhaps 10, of the effect of the embankment (before the bridge is built) on the river banks and the irrigation system. The 5¼ lakhs might be debited to the cost of the ferry and would *pro tanto* reduce the cost of the bridge when it was built. I think, therefore, that we should strongly urge the construction of the embankment and training works on the Government of India as part of the Ferry scheme and as being subsidiary to the building of the bridge and likely to reduce the estimate for that work.

6th April 1893. (Signed) J. H. GARSTIN.

ORDER—dated 2nd May 1893, No. 1192 W., Public Works.

After careful perusal of the papers on the subject, His Excellency the Governor in Council is convinced that the point raised by the Honorable Mr. Garstin, that of narrowing the river at the bridge site and which is undoubtedly one of very great importance, has been most carefully considered by the responsible Engineers; and as they are all satisfied that the dangers feared by the Honorable Member are guarded against and that there need not be any anxiety for the irrigation works, His Excellency in Council is of opinion that the intervention of Government is not necessary. It is, however, evident that when the bridge is being constructed special measures will have to be taken for the protection of the town of Rajahmundry on the northern bank, and this matter should be kept in view by the Railway authorities.

(True Extract.)

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

To the Superintending Engineer, I Circle.
" Chief Engineer for Irrigation.
" Consulting Engineer for Railways.
" Revenue Department.

Exd. C. A. Munisawmy.
Spare Copies

1192/4

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1893} Madras.

PUBLIC WORKS.

Dated May, 2nd.

Read. *Encl.*

G.O., 2nd May 1893, No. 1192 W.

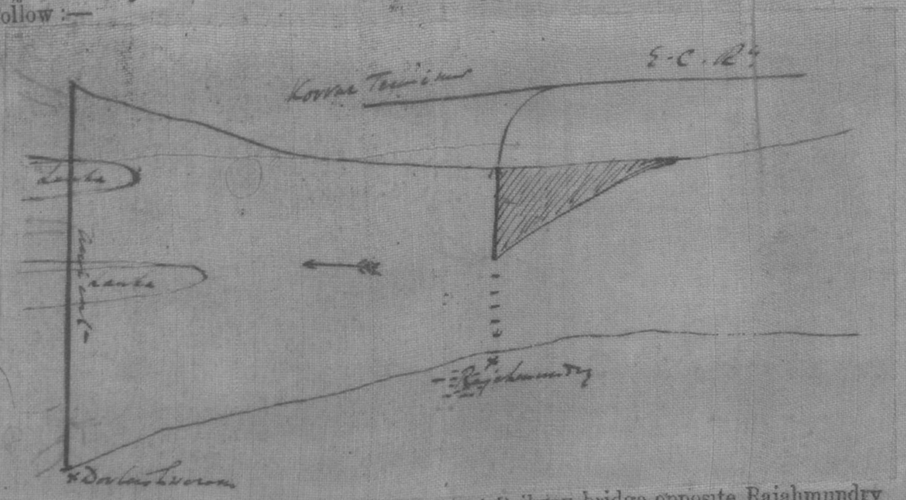
MAY.

Railway Bridge over the Godavari River

Observing that the point raised by the Honorable Mr. Garstin in connection with the narrowing of the river at the proposed site for the — has been most carefully considered by the responsible Engineers and deciding that the intervention of Government is not necessary.

MINUTE.

Having had the advantage of visiting Bezváda and Rajahmundry with His Excellency the Governor on the occasion of his opening the Kistna bridge to railway traffic, I have had the opportunity of seeing the site where Mr. Spring, the Engineer-in-Chief of the East Coast Railway and the constructor of the aforesaid bridge, proposes to bridge the Godávari, and of considering whether that is the best possible site for the bridge and also whether the plan of construction is not open to serious objections. I subjoin a small diagram which will serve to illustrate the remarks which follow :—



Mr. Spring's plan is to build the Godávari Railway bridge opposite Rajahmundry (where the river is about 2 miles wide) and about 5 miles *above* the great Godávari anicut which crosses the river at Dowlaishwaram, where its width from bank to bank is just 4 miles. Rajahmundry and Dowlaishwaram are both on the north or left bank of the river. Mr. Spring proposes to throw out a strong embankment from the right bank of the river for about a mile and thus to reduce the size of the water-way of the river, opposite Rajahmundry, by one-half and to bridge the other half. This project is estimated to cost about 50 or 60 lakhs of rupees, but its construction has been postponed for the present by the Government of India on financial grounds. I take it for granted that Mr. Spring's plan is perfectly feasible and (putting all other considerations on one side) the cheapest way of bridging the Godávari. But there is this vast difference between the proposed bridge over the Godávari and that so successfully built over the Kistna, that while the latter is built about $\frac{3}{4}$ of a mile *below* the Kistna anicut and does not, and probably never will, in any way, affect it or the great system of irrigation dependent on it, the Godávari bridge is proposed to be built *above* the Godávari anicut, and we are bound to consider most carefully what its effect, if so built, would be on that work and the still larger system of irrigation dependent thereon. It does not require one to be Engineer to see that one effect of narrowing the river-bed to one-half of its natural size will be to force the whole river to discharge itself with increased velocity through the opening left for it. I do not propose to calculate what that velocity would be at varying heights of flood-level, as it is quite sufficient for my purpose to take a flood-level of 15 feet above that of the anicut-crest, which, I presume, may also be taken to mean a similar rise above the ordinary bed of the river 5 miles above the anicut where the bridge is proposed to be built. Such a level is 2 feet less than an actually recorded rise of the river within the last few

years, so it cannot be regarded as extravagant, and it means that when a flood 15 feet above the ordinary average bed of the river is rushing past Rajahmundry (where the river is 2 miles wide) at a velocity of 6 miles an hour (which is, I believe, nothing unusual in times of flood), the sectional discharge of the river is $1{,}760 \times 2 \times 3 \times 15 = 158{,}400$ square feet, which, multiplied by the velocity, is $158{,}400 \times 8{\cdot}8 = 1{,}393{,}920$ cubic feet per second, and the effect of forcing this flow through an aperture of about half the size nature has provided for it would be to increase the velocity of the rush of water through the confined channel and to scour the bed of the river, where it is proposed to be spanned by the bridge, to a considerable depth. The sand and silt thus scoured out would be carried down the river and would either form new islands between the proposed bridge and the anicut, or considerably increase those already existing, or else it would all be carried off over the anicut and down the various irrigation channels leading from it. Of course, so long as the matter in suspension passed over the anicut no harm would be done, but any additional deposit of sand or silt in the irrigation channels themselves or above the head sluices leading to them would be a serious matter involving not only a large increase of expenditure on keeping the sluices and channels clear and a consequent diminution of the profits of the whole system of irrigation, but also tending seriously to obstruct and possibly so to diminish the flow of water for irrigation and navigation. The formation of new islands in the river above the anicut or an increase in the size of any of those now existing might also injuriously affect the set of the river in respect of the various channels. But apart from the interests of the anicut and its irrigation, those of the inhabitants of the town of Rajahmundry must not be overlooked. This town lies within a short distance of the river bank and to the east and on the down-stream side of the site of the proposed bridge, and it seems to me to be a matter of extreme probability that, if the waterway of the river is reduced to one-half just above Rajahmundry by means of an embankment projected from the opposite bank, there will be a strong set or swirl of water on the bank of the river just opposite to where Rajahmundry is situated, and that unless the river bank is here strongly protected, Rajahmundry may be washed away. I base this idea on the evidence afforded by the state of affairs at the north end of the anicut itself. Here we see in miniature what might, I believe, result on a grand scale just below the site of the proposed bridge if it was built as proposed by Mr. Spring. At the north end of the anicut is a row of under-sluices, the object of which is, I believe, to carry off the silt or sand which would otherwise deposit itself in front of the gates of the adjacent lock and head-sluice, and the effect of the comparatively trivial rush of water at a high velocity through these sluices, as well as, perhaps, of the swirl or back-wash caused by the rush of water over the adjoining end of the anicut, has worked a great hole, some 50 feet deep, just below the under-sluices and cut a considerable piece out of the river bank. This hole the anicut officers are trying to fill up with rubble stone, but the task does not seem to be an easy one. Now, if such a result follows at a point where the river is at its widest, and where the forces at work are small, what would be the result if the swirl or set of the river on a particular point of the river bank was as great as it probably would be by the results of Mr. Spring's proposed scheme? To me it seems probable that if the anicut under-sluices at Dowlaishweram were swept away in a flood the swirl of the river through the gap would in a few hours cut right through the river bank and destroy the main canal behind it, and if this was likely to result from such a catastrophe or the destruction of a comparatively small work like the under-sluices, then the result from a flood 15 or 16 feet deep swirling against the river bank at Rajahmundry though the opening left for the bridge would probably be the cutting away of the river-bank between Rajahmundry and the river and the destruction of the town itself, unless the bank was strongly revetted and protected by pitching, but if the river scooped a hole 60 or 100 feet deep in a few hours, pitching would be of little use to prevent the undermining of the bank. That there are such holes worked by the current in the river-bed is beyond question. It seems to me, therefore, to be a matter of imperative necessity that before the bridge is permitted to be built where and as Mr. Spring suggests we should ascertain from actual experiment what will be the results of confining the waterway of the river to one-half of its present size by an embankment, such as Mr. Spring proposes. The Government of India have, I believe, sanctioned the establishment of a steam-ferry to carry railway

carriages and waggons across the river, and if Mr. Spring's embankment was made and the railway brought to its extremity, the ferry could work across the one mile gap with greater facility and more rapidly than if it had to follow the route of the present ferry. Then, if the results of constructing the embankment were not found to be mischievous, Mr. Spring's plan might be carried out in its entirety, but if the reverse proved to be the case, the plan might be modified, before it was too late, either by cutting a large gap in the embankment and bridging it over, thus leaving increased waterway, or by building the bridge below the anicut, the site opposite Rajahmundry being given up and the embankment being demolished. The building of the bridge below the anicut might involve more embankment and possibly more actual bridging than in the present proposed plan, besides involving the bridging of the main irrigation canal near Dowlaishwaram, but this would be better than building the bridge opposite Rajahmundry only to find that its construction had resulted in serious damage either to the irrigation system of the Godávari delta or to the town of Rajahmundry or to both.

20/3/93 A. H. Pontin

P. W. CURRENT No. 4403

The Hon^ble W. Garstin's
Minute.

Reps: 2:5:93

1192/
2

C. a. w

With reference to the
accompa[illegible]ng memo returning
proof of the diagram to be
inserted in G.O. No 1192 W & 2^nd
1493 to the Survey office
[illegible] orders are re=
quested as to whether the
[illegible] Minutes
[illegible] permitted [illegible] file
[illegible] copies of that order.
[illegible] rule 44 of the Manual
[illegible] should be [illegible]
d and not printed in
l in ordinary space
s, but in this case
orders will not be intelle
le unless the Minutes
printed in extenso.

It is submitted that the
f of the Minutes should
be submitted to the
'ble Mr. Garstin in
rdance with the
l custom.

The proof of the

diagram was only received
yesterday from the Survey
office.

for orders.

There does not appear to be sufficient reason for postponing from the 18th. The order in the H.R. Walsh's case will be sufficiently intelligible as it stands to the Minister

R.B.
9.VI.93.

9.6

H.C.
For guidance. See with "Proof" approved the 8th.

R.B.
10-VI-93

1192
8

Despatches

Nine copies of G.O.
2nd May 1893 No 1192 W.
without the Minutes are
for communication with those
with the Minutes. Please
return original Minute after
despatch.

Rus
17/6

Bezwada

1152 14/7/91

B 11929

My dear Mr. Walch.

The Godavery project is now maturing itself. I have five sets of detailed drawings ready and corresponding Estimate, but I cannot of course submit the project to Government until I have discussed it with you. I am sending you a sketch plan of the river, as surveyed in 89. showing the alignment which I propose for the bridge and the position of the abutment and training works. You may take it from me that there is no question about the possibility

…ter I found at Inchchannon which
…de for the construction of the

What I have all through kept
U.G.S.
the thin dotted line across the piers was the
first rough alignment of bridge centre line.
But with a view to your requirement I
have slewed it round at the Junction represented
by the thick dotted line, so as to force your
ament more squarely and centrally. You will
see a third dotted line between the other two.
This third line is in just such a Junction that
a line drawn at right angles to it, and
at the centre of the bridge waterway, would
precisely strike the centre of your ament.
I understand however that the western canal
heads are a greater source of anxiety to you
than those on the eastern side, so I have
twisted the bridge line slightly further up,
into the Junction of the thick dotted line, so

…training the piers within the
…ject at a cost of
…ded for the actual training work.
…completed as a permanency.
…You will see from the plan why I
…take the precise length of bridge for
which the project has been set up. That
extremely important and practically precise
limits could not well have been neglected
…any scheme. If the limits had
been 500 ft further to the west I
might perhaps have preferred it. But
there it is, and I could not possibly
ignore its value in any scheme for
training the piers.

that a normal to it cutter my stream
Jour amont a little to the right of its
cloture, and so give a fairer chance to the
side.

Now if the river had always passed
through a rocky gorge in the position of
the present bridge and training works (as
designed) I suppose you would admit that
it could be in no fairer possible position for
the needs of your ament. My belief is
that with the bridge in the designed position
you will within the first four or five
years find that a great part of the
western sandbanks and shallows will
have automatically removed themselves

tion I found at Dodekanam which
ade for the construction of the

What I have all through had
in my mind in 1895
in my mind is your great
desire for the insertion, in the
design, of a subsidiary bridge near Aurangabad
so that a current of water may always
keep the road clear for access to your
western Canal heads. Such a bridge, say of
five or six spans of 100 ft, would be a
source of permanent danger to the main bridge,
because comparatively slight changes in
stream might at any time, during a long
continued flood, set up a strong scour through
what would really be a short cut.

This looks from your point of view, as the
man in possession, is I suppose less important
than that your canal heads should not get

river embankment.

But I believe that the very
result which you wish to avoid
would be brought about by the device of
building the subsiding bridge. A strong
silt laden current passing through it would
certainly deposit its silt as it emerged into
the comparatively quiet water beyond, and
would I believe form shallows just where
you wish to prevent them.

The gain the construction of such a
bridge in place of my training work is
an entire and radical subversion of all
the principles upon which this system
of river training depends for its success.
The main principle of all is that the
[illegible] channel should

the artificial gorge would be like if you
thought it better that I should prolong
the downstream arm of the training work
into a position symmetrical with the
Rajmandri bank. The upstream shape is
of no interest to you. With the rainfall
given the mean velocity of the water would be
6·9 to 7·1 ft per second, according to the
greater or less number of obstructing piers in
the central design. I have assumed a volume
at maximum flood of the latter. If the
mean velocity is at present something less
than 6 ft per second, as it possibly may be,
the extra foot will mean some very slight
backing up (an inch or two?) at the up
stream side of the piers which will not affect
your river embankment.

But I believe that the very
space at the back of the up stream arm of
the training work should be widened late of
counter water, so that should the prince
attempt, as it always will sooner or later
attempt, to take it flankwise, it may be
defeated after the first few days or hours of
such attack, by finding itself engulfed, as
the detour becomes too long, to take a short
cut, and there to find itself back in the
position in which it was running when it
began the attack; and so on, again and
again, until the flood has subsided, and
the up stream condition get altered for a time.

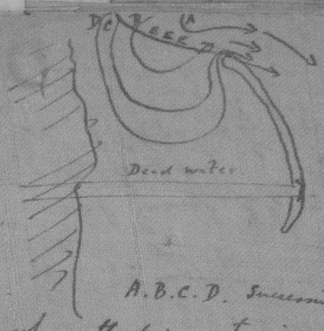
I have just two dotted red lines on the
plan showing what the mouth or reach

To me who have come from
velocities of 12 or 14 ft per
second and a wave of 3 ft
against the up stream entrance of
my jetties, so that at five or six feet
of flood no boat could be poled through,
these Godavery bajan appear very mild
ones.

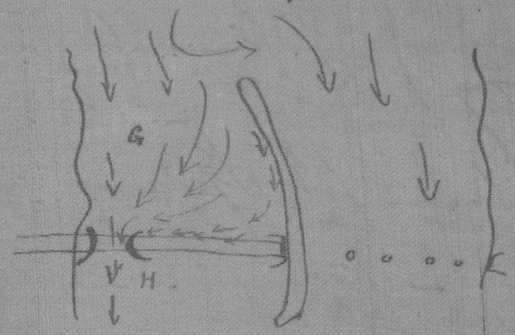
I hope to have Col Cotton here about the
29th and as I shall then go into the
whole matter with him. I shall be greatly
obliged if you can let me know fully
what your views are before that date.
I need scarcely say that I will do for
me possible modify things to suit your

[illegible] the [illegible]
Tides, and if later on I take
up the project to Steam and
we shall have further opportunity for
talking it all over, before it takes
final form for submission to Government

Yours Sincerely
Elmer L. Sperry.



A.B.C.D. Successive positions of main stream when attacking a training bund flank-wise.
E.E.E. Subsequent position, suddenly taken up, when the detour becomes too long. and so on, successively.



G Chronic condition of things if there is a subsiding fixity at H.

But I believe that the

115/15 Blizard

23/7/91

My dear Mr Walker.

When I wrote to you the other day the Godmanchester Bridge scheme was only in process of forming itself in my mind and I had got as far as about an eight approximate estimate of the cost of a many different designs of bridge. I send upon the length of bridging shown in the tracing which I sent you.

Since then things have been getting further into shape. and I have got more figures. and I am able to send you the latest scheme, which as you will see, is a considerable modification of the earlier one.

I have now got a figure of £1,35,000 as for the abolishing of the piers, which

55
04
Walker

as a matter of no scientific importance; because the present width of the river is a mere function of the instability of the material of its banks and bed. a state of things which is to be rectified by the stone guard training works. The mean of 7 ft is really a very insignificant current when you come to look at it. it is only about 5 miles an hour. 1152/16

If you take 11.35,000 breadth 23 depth of 200 feet. or 31 depth of 150 ft. that is through a length of 4900 ft of bridge as I now propose to do. at a mean velocity of 5 miles per hour. is the minimum the mean depth of the river, below the bridge, is 37 feet. The present min

B. T. P. C. Office

depth of the same series of piers
31 feet. so that I may suppose an
over increase of depth of 6 feet.
Channel by Landsby narrowed to
all over 10 feet, and in the
Rather calculation I suppose
one of 8 or 9 feet. so that the
which I propose for the Sunday
bridge: nb is not in my opinion at all
subsequent. In illustration of the
mention that for a depth of 1800
of it had the Sunday at Indy at
deeper than 37 ft. and that for
600 feet it is from 50 to 56 ft
The latter depth he has scarcely met
Pilfold Sunk 9 ft. Surface velocity

A reference to the accompanying
plan will show how my
latest proposal, viz 4900 ft of
bridging, stands with reference to
your ancient. It is very much more
favourable to your western canal heads
than was the scheme of which I have
already sent you a tracing. 1192/17

I hope you will agree that it
entirely does away with the necessity
for a second bridge or alongside the
west bank. Indeed the latter would
in my opinion do you far more harm
than good. and it would be fatal

1852
25

My dear Mr Walch.

When I wrote my letter to you of a day or two ago I had not received yours of the 20th.

I herewith send you a section of the seam as settled by boring right across at every 200 feet for the greater part of the way. You will see from the blackness and continuity of the clay on the western side, that the main seam

Bx 911. to. to.

[illegible] at any time of
the waters carried a water
[illegible] the Kyamanis in the Sandy
Jantion. The Kyamanis
[illegible] at the western half of the
[illegible] it appears any real channel
[illegible] Let their upper ends they are not so
[illegible] when they are in the old position. I had
[illegible] of the last of them. and they
[illegible] dead water. The old flow. I ought
[illegible] by Engineers for several months now
[illegible] I spoke of a strong current on it
[illegible] the western side in the flood season. Now
[illegible] flow at the end you will recollect

[illegible] to seems from
I daresay that it is the case but if
[illegible] have not particularly observed it in
[illegible]. — There is always a swift current
[illegible] just such a place on the west bank of
[illegible] Godavery Mouth Bypass, during
[illegible] flood. Because it is a short cut
[illegible] across a Return of the main stream
[illegible] and the full [illegible] quantity of water
[illegible] In a Northern Direction with an existing
[illegible] established bed this artificial current would
[illegible] the head would in a few hours or days
[illegible] establish at the west side just such a
[illegible] channel as is running at the Bypass
[illegible] side; and the latter would in a few hours
[illegible] or days silt up and do no further

thrice or thrice during a season. But
the underlying clay shows that
if the soil occurs in these Gaud
Granitoid Sandy bed rises on this
of Indi. If anything greater than
a merely superficial change has
occur it is the gradual result of many
Seasons of floods. The swift current
is there, which you noticed, across the
short cut, but it does not carry any
considerable volume of the water of the
river, the great mass of which is in the
main deep channel. Since I sent for
the last train I have again slightly
changed the bridge alignment, to lay

Possible to secure your
concurrence at all points.
From the west abutment of my last
tracing, that is from a point 4900 feet
from the Rajahmundri end of the bridge,
please draw a line tangential to the main
land below Kurnagabed, when it projects
out into a great bulge or almost a
promontory. I mean the main land
where your embankment is, and not merely
the island. This line then drawn would
be the alignment of the western
training work. The alignment of bridge
would be at right angles to the line

[illegible] Thames there, we would pass
[illegible] through the same point at
[illegible] Rejahmandri as heretofore. That
[illegible] have travelled the Indg line
[illegible] further round we upward.

This gain for you from Rungabad
downwards the entire benefit of
the breadth of river which you at
present depend on. So that I depre
for of nothing useful. What I fe
for of is the mischievous stream
which flows past Rungabad

Bellg, and is outwards towards mid
current, past the Indge of the main
bank steady reformed it. Caused the
steady deposit of silt on its right
flank in the slack water near the
head of your western Canl. 11[illegible]/2[illegible]

I think you will be able to make
out this without a sketch.

The construction of the suggested subsidiary
bg would make that objectionable and
silt-depositing current a permanent
trouble to you as it is at present.

I hope you understand that the

Ac 17/8/91

Bezwada
6/8/91.

My dear Mr. Walch. 115a 21

I am very glad to learn that you offer no further objection to my plans for training and bridging the Godavari.

Now about headway, and first about steamers. In Bengal we had a lot to do with the question of headway on several navigable rivers, and I think that something like 40 feet was claimed, and successfully, which I need scarcely say would be utterly preposterous in the Godavari. The Railway is [illegible] in the field, and possible future steamers must adapt themselves to circumstances,

scheme is only being gradually matured in my mind, and that I have not arrived at any settled conviction, beyond a first degree of consideration to the principles of the proposed training. What I have written in the report, so far as it has gone, is that I recognise that we are working out a scheme which, should it will be, only 5 miles eventually from a similarly permanent work, the anicut, must in conjunction with the anicut result in a tolerably permanent cutting of main bed between the two: and our aim must be that this permanent condition shall be the best possible condition for the canal head.

Yours sincerely J H Gr[illegible]

Ofs 5-3 4106/93

They will never run into a flood which has risen higher than 900 feet over the anicut; it would pay them to run the piers, and when they run let them lower their funnels like all civilized steamers, when passing the bridge for one or two minutes.

The Bengal river steamer Companies had an old vested interest, and had been doing a heavy business for years, but the in the Godavari is altogether different. I ha roughed out an estimate, and don't think that half a lakh would cover the cost of adding 3 feet to the height of the bridge

About boat traffic, I offer them 9 feet above a flood level which occurs once in twenty years and then lasts at longest for a day or two; half a lakh seems a heavy insurance premium for Government to pay against the extremely small risk, especially when the ends in view can be encompassed more cheaply and easily by an order that boats must not run, or at their own risks, beyond a certain place, when the river is above a certain mark at the place where they start from. They won't of course go up stream during such a flood.

I offer headway which I roughly estimate to be amply sufficient for 360 days

out of the 365 in one year out of 20, and
all 365 days in the other 19 years. I don't
you would suggest the expenditure by
of half a lakh to insure against so slight
risks in the case of any of the canals.

Will you kindly reconsider your
Suggestion and let me know what you think
I of course keep matters entirely unprejudiced
till I hear from you.

Yours Sincerely

C.V.

Dec 8.2
4100/53

Bldwd.
15/8/93

My dear Mr Walch.

I have arranged as follows for the Godavari Bridge level without waiting to hear from you. and I hope you will agree to them.

1	Canal datum M.S.L.	= 0.00
2	Invert crest	38.00
3	Lowest low water above invert	34.50
4	Top of well.	34.00
5	Top of piers	72.66
	Under side of girders	75.00
	Formation	76.25
	Rail level	77.75

9. Highest known flood at mint 5'.9
10 " " " " bridge + 63.6

Of these figures the only one of any interest to you are Nos. 6 and 10.
They show a clear height for boat traffic of 63.6 − 75.0 = 11.4 feet.
This you allow to be sufficient.

I think however that it is well more than you want, because I can scarcely believe that there is a fall of 7'.9" for 2½ miles even in the highest floods between Docklands & Rochdale.
That however is what is shown on

Section I found at Docklands which was made for the construction of the new embankments. W2/24

Talking of new embankment, I have just money into my estimate for protecting Oysterpetts. as you suggest.

Will you kindly write a receipt of this if you approve of the heights. This I think leaves no further point of disagreement between us. Do not this so?

Yours sincerely
Thomas H. Lyons 7.10

Scat- Telegram
19/8/91

I think eleven
feet - Level four
above maximum
flood level will do -
I wrote in detail -

Oks 5.1
4106/53

1192
25

Ooty
20th July 1891

My dear Spring

I must ask you to send to me, to consider with the plan which has come with yours of 14th instant, the soundings which doubtless you have had taken along the proposed line of embankment (across the Western channel) and of the Bridge I have - as I am sure you know - every desire that you should not be hampered in carrying out your ideas by any undue nervousness about the Irrigation works and I quite understand how any openings for the Western channel would seriously affect the principle on which you wish to design your bridge works, but I am bound to be very careful in the matter and to study all available information which can affect my decision. Leaving the question of the amount and the canals below the bridge for the present I can at once tell you that if you construct your

your bridge and training works at all as you propose you will have to undertake a very thorough protection of the left bank of the River from Rajamundry to above Kotalingala which otherwise will, from the way in which the "set" on it will be intensified, be swept away, to the swamping, if not destruction, of "Lisserpettah" and other parts of Rajamundri. That pettah was built, or partly so, a few years ago when I was away from the district for about two years, or I would have protested against its being started in so unsuitable and dangerous a place but as it exists the bank which prevents its being destroyed must be efficient against attack.

Yours

(Sd) G. T. Walch

Colvin

1192/2

Government of Madras.
Public Works Department
Octacamund.
1. August 1891.

My dear Spring,

Yours of 23rd and 25th ultimo. The plan with the former is, from my point of view, a decided improvement on that with yours of 14th, and as regards its probable effects on the anicut and head works I will make no objection. You speak of your works resulting in a "tolerably permanent contour of river bed between your bridge and the anicut; such a Contour may be possible where your works confine the river to a Comparatively narrow channel, but is not possible in a reach from 3 to 4 miles wide which has at times to pass about ~~Lak~~ 1-21 millions of cubic feet, at others not 5000 cubic feet per second. Under such Conditions, varying shoals and sandbanks are inevitable, and neither you nor I can predict what their forms will be. I do not see any reason to suppose that they will be worse if you carry out your proposals than is now the case, and therefore I shall not object to those proposals

proposals, that is all I can say on
that branch of the subject.

In my last I drew your attention
to the necessity for your protecting
the bank of the river above Rajahmundry and now having seen the
section which shows the proposed bridge
I must notice the subject of leadway.
You apparently propose about 8 feet
above highest known flood, now though
during such a flood there is but little
navigation on the river, boats do
sometimes even then come down
from places below the gorge to
Rajahmundry and Dowlaishweram
and you will be bound to give at
least as much leadway as we have
to give on our first Class Canals viz,
11 feet.

Now the question of steam navigation
of the river in connection with Coal
mines on it will have to be considered. Already I believe a company has been
formed for working such mines and
I heard a rumour that it had already
ordered a steamer; Marwick of Messrs
Hall Wilson and Company Cocanada
can tell you about this.

I hope you will have readings
of the level to which the river rises
at Rajahmundry during the floods of
this year taken.

(Sd). G. T. Walch

152/27

Government of Madras.
Public Works Department.
Ootacamund.
17. August 1891.

My dear Spring,

I ought to have
replied to yours of 6th before. I do
not agree with you that as regards
the steam navigation of the Godavari
the "railway is first in the field."
There were till a very few years ago
three large river steamers belonging
to Government which made periodical
trips to Bhadrachellam and Duma-
gudem during the season of floods
each year; their upper decks were
probably (I think you will find one
of the steamers still at Dowlaishwaram
some 15' above water line, the funnels
running up considerably higher; they
did not start up the river if there
was more, I think, than 6 feet on
the anicut and the river was
rising - but they used to come down
on higher floods, though never on
very high ones. Wybrow can doubt-
less get you information on

the

the subject.— I still think you will have to give 12 feet headway above M. F. L. and considering that whacking big trees, with heavy branches, come down the river on high floods, 8 feet would, I should think, be running it rather fine respective of navigation. If I am asked to give an opinion on the matter I shall say that I consider that half a lakh would be well spent in making the headway 12 feet instead of 8 feet.

Yours sincerely

(Signed) G. T. Walsh.

1152
28

Note by W. on the proposed Railway bridge over the Godavari river.

—

Instructions typed on the returned paper from circulation

—

(Done) "Send again to the Hon'ble Mr. Gaslin. When returned send file to R for perusal and return him with a copy of my "note" for record.

(D.O.Gyro
14/4

* This will be printed and communicated to the C.E. for Rys.
22-IV-53

152/29

38

Note 3

With reference to the minute d/ 28th March/93 of the Honorable Mr Gonstin on the proposed Railway bridge over the Godavari river I have the honor to offer the following remarks.

2. The correspondence herewith will show that the matter has already received my attention

Letter (d/o) from Mr. Spring d/ 14-7-91
Reply " to - - - - d/ 20-7-91
Letter " from - - - - - d/ 23-7-91
" " " - - - - d/ 25-7-91
Reply " to - - - - d/ 1-8-91
Letter " from - - - - - d/ 6-8-91
Reply " to - - - - d/ 17-8-91

3. I had accepted as final the decision of the railway experts, including the Consulting Engineer for Railways (Col. C.J. Smith) & the Director General (Sir Guilford Molesworth) that

10
I fully intended, when I wrote my first minute, that if the Embankment from the Rentida of the Godavari was connected Railway, & practically the training works in connection with it, contemplated by Mr Spring, should also be erected -

that the difficulties & cost of taking the railway below the anicut were prohibitive, though of course I would from an Irrigation point of view much prefer that the bridge, or bridges as they would have to be, should be built below the anicut where there could be no possibility of injury to irrigation interests.

4. There had been conversation between the Consulting Engineer and myself, or Irrig. official correspondence of which I have no copy, about the present proposal, and then the correspondence referred to in para 2 took place.

5. It will be seen

12/182
12/30

6/4/93

7 Apr

after going through the papers put up, I think it is evident that the point raised by the Hon. Mr. Garstin, and which is undoubtedly one of very great importance, has been most-

× See section

from the section here-with, (sent to me by Mr. Spring with his letter of 25th July 1891) that though it was proposed to run an embankment across about 5/11 of the breadth of the river, the discharging area at high flood level which would be closed would be not much more than 1/3, because where the embankment is to be placed the river bed is high as compared with what it is under the bridge openings; in high floods also the proportion which the "obstructed" would bear to the "free" area would be even less, because at such times much of the sand overlying ×

the rock and clay near
the left bank (where
the "set" of the river
now is and its
velocity greatest) is
swept away, whilst
over the high portion of
the bed where the em-
-bankment is proposed,
the velocity is so much
less that the bed does
not scour out to any-
-thing like the same
extent.

6. Thus the portion
of the river to be left
free for discharge under
the proposed bridge now
passes much more than
half the total discharge
of the river, and it
would not therefore under
the new conditions be
called on to perform
anything

carefully considered by the Engineer
and as they are now all satisfied
that the dangers feared by the Ho.
Member are guarded against, and he
need not be any anxiety for the
irrigation works, I am inclined to agree
with Sir H. Stokes that we need not
concern ourselves now about the matter.
It is evident though that when the
bridge is being constructed, special
measures will have to be taken for
the protection of Rajahmundri which
on the northern bank

10 lakhs

Seen. I do not think any
of these remarks are likely
to be made.

21/9/93

2182
21

anything like double
the duty which it already
performs.

7. But though the
extra quantity which
will have to pass the
section of the river to
be spanned by the bridge
will not be anything
like 100 per cent more
than now passes that
way, it will be consider-
-able, & will require an
extra mean velocity at
the place; that velocity
need not however be
alarming or in any way
comparable with the
state of affairs at the
anicut under sluices
which the Honorable
Mr. Garstin refers to;
through them the water
is discharged in a

1152/25

boiling torrent, often a cataract falling many feet from the water level above the anicut to that below it, at the bridge the water, led on to the bridge by training works, would glide through it into a current which though rapid is not greater than is now seen in parts of the river - Mr. Spring took the probable velocity to be 5 miles an hour, or 7·3 feet per second, & I see no reason to expect that it would be greater

8. That even this velocity wherever it occurs will scour out the sandy bed to a consi= =derable depth is certain; and the result will be a probably permanent deepening of the bed at the bridge site. It seems to be thought that the extra velocity caused by the bridge works will affect the river bed over great distances & cause a much greater general travelling down of its sand than is now the case; but this will not be so; the extra velocity will probably not come in to play for any considerable dis= =tance above the bridge & will certainly disappear at a very short dis= =tance below it, so that the extra amount of sand that will be removed from the place is not likely to be of serious moment

9. No doubt the

∴ 23 Spans × 200′ (afterwards increased to 19 of 250′)	= 4600	Sq. feet
4600 × 25½ depth from high flood level to Summer level =	117820	Square feet
4600 × 12′ Extra depth below summer level - (already portion of the bed at the place is much lower than 12′ below summer level)	55200	
	173020 Square feet	

1,210,000 C ft. per second the discharge assumed, orig.ly

÷ 173020 = 7 feet velocity

disposition of the shoals
+ islands, which even
now is constantly
altering, will be af-
=fected by the railway
embankment - It
passes the wit of man
to predict exactly what
will occur; Mr. Spring
thinks his proposed works
will "result" in a tolera-
=bly permanent contour
of river bed between the
bridge & anicut; whilst
I do not think so but
see no reason to suppose
that the ever varying
shoals & sand banks
will become "worse" if
he carries out his pro-
=posals; and I see no
reason to fear that any
appreciable extra quantity
of sand is likely to be
carried

* see his letter 25/7/91

* see my letter 1/8/91

1182
23

carried to the canals.

10. Passing now from the consideration of the effect of the proposed bridge works on the bed of the river & on the irrigation works, to that of the effect on the left bank near Rajamundry; it will be seen that in my demi-officials to Mr. Spring I drew attention to the absolute necessity for "very thorough protection" of the bank for some distance above Rajamundry where the "set" of the river which already exists will be intensified, and I spoke strongly on the subject to the then Consulting Engineer for Railways.

11. Below the bridge the margin of the river

is I believe for some
distance rocky, and
as the stream will
almost immediately after
passing the bridge be
free to spread out to
its former width it is
not probable that
increased velocity of
moment will there exist.
It is possible however,
that at first, & till the
river at the place ac-
-commodates itself to
the new conditions, there
may be a "swirl" at the
place, and if the margin
of the river there is not
rocky, artificial protection
should be provided which
will prevent its being
eroded or undermined.

12. As regards the
Honorable Mr Gardiner's

152/24

proposal to construct
the embankment &
try its effect for some
time before building
the bridge, it must be
remembered that if
this be done the in-
-tended costly "training"
works which are to
"lead" the river quietly
on to & away from its
restricted channel must
also be carried out;
it would never do to
let the embankment
jut out into the river
by itself at right angles
to the stream, causing
a mighty swirl round
its end; * these the experi-
-ment would pro-
-bably render the con-
-struction of the bridge
piers more difficult

certainly. Not complete
this report in detail
intended to supersede the
training works.
JH

permanent
JH

* the protective works
referred to in para 10
of this note would
also have first to be
provided, and

& costly than would
be the case now, when
many of them could
be founded on wells
sunk through the
sand, as at the
Kistna.

13. In the marginal
note to para 7 of this
note the maximum
discharge of the river
is taken at 1,210,000 Cft.
per second, as that was
accepted when the corres-
-pondence took place;
but subsequently a
higher flood than before
known, & recalculations,
convinced me that the
maximum discharge of
the river was not less
than 1,500,000 Cft. per
second & I at once
so informed the Consulting
Engineer

115
25

I do not see this
G.O. or the correspondence
printed with it when I
printed the rest of the
papers in question
Dec

Engineer for Railways.
Mr. Spring, influenced
no doubt by a desire
to keep down the size
of the bridge, demurred,
& the correspondence
given in P. W. G. 3112 R
of 29th December 92 took
place. As in calculations
such as these dealt
with, coefficients have
to be used which are
to some extent matters
of opinion, & as in a
river such as the Godavari
of greatly varying depths
& sections, the mean
velocity cannot be de-
-termined with any
certainty, it is impos-
-sible to assert that
the result arrived at
by us is absolutely cor-
-rect and no other, but

I feel convinced, as does Col. Drake-Brockman, that it is not excessive, and it would be but right to increase the proposed clear opening under the bridge accordingly.

14. I would also draw attention to the portion of the correspondence referred to, stipulating for a clear head-way of at least 11.4 feet above the highest flood level; it is to be hoped that the level to which the maximum flood of October 1891 rose at the place was observed and recorded.

3/4/93 C. Stewart

1192
36

P. W. CURRENT No. 4106

Ex. Am 3113 1 Dy. 12. 12
. . 3112 R Dy 29. 12 - 92

4107/1

1152/26 Encl

Special

2) His Excellency the Governor.
(1) The Hon'ble Sir Henry Stokes, K.C.S.I.
1) The Hon'ble W. Garstin C.S.I.

Encls 6 (Khan)
Regd: 2. 5. 93

Clerk Engr

0 12/4 Old 35-4 Hm 19-4
circ 5/4 R 6/4 A 1. 5. 93

1152/37

No. 1192-W of 2nd May 1893.

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

READ the following

Minute by the Hon. Mr. J. H. Garstin C.S.I. d/ 2 May 1893.
Note by the Chief Engineer P.W. Dept. d/ 3rd May 1893.
Minute by the Hon. Mr. J. H. Garstin C.S.I. d/ 6th May 1893.

Short proof please Sir

After careful perusal of the papers on the subject, His Excellency the Governor in Council is convinced that the point raised by the Hon. Mr Garstin that of narrowing the river at the bridge site, and which is undoubtedly one of very great importance, has been most carefully considered by the responsible Engineers and as they are all satisfied

Hes
16/5/93

1192
38

satisfied that the dangers feared by the Honorable Member are guarded against, & that there need not be any anxiety for the irrigation works. His Excellency in Council is of opinion that the intervention of Government is not necessary. It is however, considered that when the bridge is being constructed special measures will have to be taken for the protection of the town of Rajahmundry on the Northern bank and this matter should be kept in view by the Railway Authorities.

DELIVERED
20 JUN 5

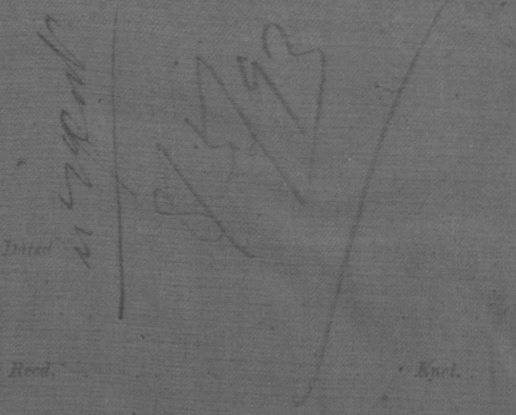
To
The Secretary to Government
Public Works Department

4107

1-10-31 Bill

Govt. of {1893} Madras.

PUBLIC WORKS.



1192/93

No. 1192W.

Dated 2nd May 1893.

Railway bridge over the Cadamnaipeer observing: Considering that the Joint report of the Hon: Mr Gantin in connection with the narrowing of the river at the proposed site for the — has been most carefully considered by the responsible Engineers and deciding that the intervention of Government is not necessary.

2 L 2/5