

No. 797. Read the following letter from Major C. J. SMITH, R.E., Deputy Consulting Engineer for Railways, to Lieutenant-Colonel J. MULLINS, R.E., Officiating Secretary to Government, Public Works Department, dated Madras, 15th July 1875:—

I HAVE the honor to report that in accordance with the instructions conveyed in the Order of Government, No. 1,415-A, dated 21st May 1875, I have examined the Pooniar Bridge at Cuddalore in company with the Acting District Engineer, and furnished that officer with a note conveying my views as to the present state of the bridge and the work necessary to secure it for the present season temporarily, and hereafter permanently.

2. As the Government have been already informed, the foundations of the bridge were 3 feet of solid work on 5 feet wells. Piers Nos. 1 and 4 have subsided at both upstream and downstream ends; No. 3 at the upstream, and No. 2 at the downstream end only, as evidenced by small cracks in the pier faces; and in addition there has been a settlement of each pier in its entirety, No. 4 to the extent of 6 inches, the others to a lesser extent. The effect on the arches has been as follows: No. 1 arch from the north has a diagonal crack larger at the extrados than the intrados, extending from springing line near the downstream end of No. 1 pier to about same level at the upstream end of the abutment. The two halves however represent as it were corbelled arches, each complete in itself and sound. The north abutment and No. 2 arch are unshaken. No. 3 arch has followed the piers in their settlement, is much flattened, and slightly cracked in four places at the soffit; the cracks however hardly extend through the thickness of the arch, and for not more than one-third the width of the bridge. No. 4 arch is damaged to about the same extent and in the same manner; both arches have so settled as to cause a very slight separation between their crowns and the upper work. All four arches are, I believe, safe for ordinary traffic; but as a precautionary measure I have recommended that the roadway be limited over Nos. 3 and 4 arches to 15 feet from the downstream parapet wall.

3. So long as no further subsidence takes place, the bridge may, in my opinion, be thrown open to the public; but during freshes, however small, the various cracks should be examined and reported on daily, and at other times periodically, by the maistry in charge.

4. I am of opinion that eventually the five north arches will have to be rebuilt, the present four piers being removed with their foundations to as great a depth as a good timber coffer dam will permit, and the new piers being built on solid foundations. I fear it will be impossible to found them on cylinders owing to the old wells and debris. I would then sink two parallel rows of 6 feet cylinders, 20 feet deep, at a distance of 24 feet from the retaining walls, one above, the other below bridge; these rows being connected by two cross rows, one at either bank meeting the wings, the space thus enclosed being floored with concrete or brickwork.

5. To protect, for the present, the surface of the sand on which the bridge now rests from further disturbance, I have recommended that laterite rubble aprons 2 feet thick be laid in under the arches where the floor is gone, and that it be laid 2 feet 6 inches thick to a distance of 18 feet above and below bridge. To protect the sand beneath from erosion, and the stone itself from slipping beyond the 18 feet line, to the space

that will be occupied by next year's cylinders, I have recommended lines of 15 feet sheeting piles, the nature of the material being decided by the Acting District Engineer after further inquiry and experiment.

Mangoe planking 10 inches by 4½ inches shod and hooped would, in my opinion, be best; and it could be withdrawn and used for the well curbs and coffer dams for the permanent work. Casuarina or palmyra piles would be cheaper but less effective. Should piling prove impracticable, I have recommended that fascine mattresses be made up under each arch, dragged into position, staked down with 12 feet stakes, these latter being firmly secured to one another with wattling, and the crib work thus formed fitted with laterite boulders. The objection to this method is that the future permanent floor will have to be built on a substratum of brushwood, and might, I fear, settle as the wood decayed, otherwise the tendency of such a mattress to sink at the outer end and follow the scour makes it a very effective protection.

The protective work on the upper side, of whatever material made, will be carried past the first sound arch, and finished off parallel and close to the retaining wall, that there may be no set from the piling upon the sound wells.

6. To lessen the present lateral tendency of the current, I have recommended that the north bank be protected for some 300 to 400 yards by brushwood groynes 40 yards in length, 80 yards apart, laid at an angle of 30° to the bank.

I have also recommended that, as soon as ever the protective work is complete, the large groyne erected to divert the river from the damaged arches be removed; as it must cause a set upon the sound arches in the event of a fresh of any size occurring.

7. I cannot ascertain that there was any greater head of water at this bridge, during the recent freshes, than 2 inches; and the sufficiency or otherwise of the waterway is so dependent upon the future regulation of the river above that it must be dealt with in the same project. Six arches can easily be added if wanted.

8. From what I have seen and heard, the river may be regarded as completely under regulation at the Trikalore Anicut, and here the volume of water to be dealt with and carried under regulation to the sea may be ascertained. It is, I think, clear that the river for some miles flows through banks which offer little more resistance to erosion than the bed itself, and the tendency of the river is to reduce its velocity by widening its section and reducing the depth; hence the various old beds, the two Malatars, the Coryaur, and now others of recent formation not yet named. Wherever the banks happen to be of good stiff clay, as opposite the chuttrum 9 miles below the anicut, the bed will be found level and clear and the surface fall increased; where the banks are almost pure sand, as at the railway bridge site, the sections show a wide straggling bed, choked with islets, and a flattened surface fall. As has been shown during a succession of comparatively dry seasons, the river bed has been capable of passing a fair fresh without the velocity exceeding that which the bed and banks will stand; and what this standard of fresh is may be easily ascertained; but directly this is exceeded erosion of the banks takes place, and the river spills with nothing to check it in its course towards the Gaddalum, a river only 6 miles off, lying 30 or 40 feet lower, with no dividing watershed.

9. The treatment of such a river ought, it appears to me, to be precisely that followed with the Tanjore rivers, viz., to maintain river section, in the combined branches

natural and artificial, sufficient to carry off the highest known floods with such a moderate velocity that the banks, protected if necessary by grass, may not be eroded and the "train" of the rivers disturbed, and to secure to each branch its allotted share. That such regulation is feasible in the Tanjore I have no doubt whatever.

10. The interference with the river of the last few years has however, in my opinion, not only not mended matters, but much aggravated the wandering tendencies of the main stream. The Coryaur embankment has had for its object the exclusion of the river from two of its flood outlets, and the forcing of the entire volume, that far carried by a river section varying from 17,000 to 18,500 square feet, through a rock-floored gorge, affording with the normal river depth in flood scarcely 4,000 square feet. This bank has three times failed; it has this year been reconstructed of stronger section and with additional precautions. It is impossible to predict the result if it stands. I see from the correspondence that in a 6-foot fresh on the anicut the volume passed through the gorge below would not, it was thought, be much, if at all increased, so high was the old bed at the embankment site; but with last year's freshes it is not difficult to show that the call made upon this reduced section was enormously increased, and that what might have been advisable when the bank was first designed is no longer feasible. The general opinion among the villagers whom I asked (and several experienced Department Public Works employes held the same opinion,) was that if the embankment stands the river banks must yield elsewhere with freshes such as those of last year. However this may be, it appears to me that its result will clearly be to raise the velocity in a river where it is already so great that the banks cannot resist it, and to cause fatal sets and consequent breaches. If I am not misinformed, the construction of head sluices to the various river channels has had or will have the same effect, and that to a greater extent than usual, owing to the relative capacities of the river and its distributing branches. The miles of embankment lately thrown up close to the river edge, however necessary for the protection of valuable property, can have no other result. The evil effects of these arrangements have probably been gradual and cumulative during a succession of light years, and it required a full river to demonstrate them. A much smaller fresh may, however, in future be expected to produce similar results, for the main stream was last year blocked up with the debris of eroded banks; new flood cuts were opened by the river in the direction of the Gaddalum to compensate for this loss of section, and I am informed that even small freshets last year kept the line inundated; in other words the river had cut for itself and maintained a new deep bed. These new cuts have now been embanked, and the first full fresh must re-open for itself a new deep bed along its old course, at what risk to the banks is well known.

11. The importance of the early regulation of this river to the Railway Company, and therefore to Government, can hardly be exaggerated. The foundations of a costly bridge of seventeen openings, each of 100 feet, are commenced, but I feel convinced that for several years to come the river will not, in the event of high freshes, be compelled, in direct opposition to its own present tendencies, to cross the railway at the point provided for it; and I see no alternative but for the Company to carry their line across the valley on a protected roadway little above paddy-field level, and to allow the river spill to pass over it, the raised line being completed when the river course is sufficiently permanent to permit of its being done.

*Proceedings of the Madras Government, Public Works Department,
28th July 1875.*

The discharging capacity of the bridge, as at present designed, is based on a depth of 10 feet, at a section where the highest flood last year gave a mean depth of something under 7, the reason given being that scour may be looked for if the river is embanked. I cannot think that such a depth "above present river bed" can ever be reached in this river. On the contrary, I believe that its successful regulation is entirely dependent on the maintenance of wide sections, small depths, and low velocities.

12. It was with a view to decide for myself how far the present treatment of the river might be relied upon, to secure it in the course bridged for it, that I was led to inspect the various branches, and to inquire into the past and present history of the river. I trust that in laying before Government the conclusions at which I have arrived I may not be considered to have transgressed the legitimate scope of the duty I was directed to undertake.

No. 793.

ORDER THEREON, 28th July 1875, No. 2,198.

CIVIL WORKS, No. 5.

MAJOR C. J. SMITH'S report, submitted with reference to G. O., 21st May last, No. 1,415-A, deals with two subjects, *viz.*, the requirements of the Pooniar Bridge near Cuddalore, and the circumstances of that river below the Trikalore Anicut.

2. Major Smith, after detailing the protective works necessary to prevent the fall of the injured arches of the bridge, of which measures he has furnished the District Engineer with notes, states that the five arches at the north end with the four piers appertaining to them will have to be rebuilt. The protective measures recommended are approved, and the District Engineer will report at once what steps he has taken to carry them out, and by what date it may be anticipated that the bridge will be safe from further injury, and its full water-way made available by the removal of the large groyne erected to divert the river from the damaged arches.

3. On the question of increase of water-way, Major Smith states that a decision should depend upon the treatment of the river above, and on the extent to which other channels than the main line of the river may be utilized to carry water in heavy freshes. The opinions he has formed as to the danger which will result from excluding certain old lines of outfall from the duty of conveying their share of flood water, will be fully considered in deciding upon the embankment of the river. In connection with this latter subject a survey establishment was sanctioned in G. O., No. 190, dated 23rd January 1875, but as yet no report on the result of the investigations made has been submitted. The District Engineer will lose no time in submitting a report. It appears, further, that the extension of the levels over the country traversed by the spill of the Pooniar in heavy floods, and along the several courses or bye-washes by which at such times part of the flood waters is conveyed, will be requisite. The railway levels will no doubt be of use in this connection.

4. The proper treatment of the river will be carefully considered by the Chief Engineer for Irrigation as soon as the necessary data become available.

5. The District Engineer will show on the plan of the bridge the permanent works recommended by Major Smith to be carried out, and, as these cannot at present be commenced, they will be finally considered and determined upon in the light of

*Proceedings of the Madras Government, Public Works Department,
28th July 1875.*

the discussions which took place on the subject of the arrangements considered desirable for the future security of the Palar Bridge near Vellore. The papers to be submitted should include a survey of the Pooniar for several miles above and below the bridge with levels and cross sections, so that it may be seen what additional effective water-way can be provided and in what position.

6. The construction of embankments on the margin of the river, referred to in paragraph 10 of Major Smith's letter, appears to have been unauthorized, and seeing that a comprehensive settlement of the measures required had been ordered and provided for, no work of this kind should have been undertaken without the concurrence of the Chief Engineer for Irrigation. The District Engineer will show what has been done, in what positions and at what cost, and he will explain on what grounds any thing of the kind has been carried out.

7. The Government approve fully of the extension of Major Smith's investigations beyond the immediate matter on which he was deputed.

(True Extract.)

Major, R.E.,

Offg. Joint Secretary to Government.

To the District Engineer, South Arcot.
" Chief Engineer for Irrigation.
To Major C. J. Smith, R.E.

Ed. S. T. Austin.

Spare Copies

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B.
Railway Department.

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CONSULTING ENGINEER'S OFFICE.

No.

Madras, 15th July 1875.

From • Major G. J. Smith, R.E.,
~~Lieut. Colonel J. H. M. SHAW STEWART, R.E.,~~

Dy. Consulting Engineer for Railways,

To Lieut. Col. J. Mullins, R.E.,
~~Colonel G. W. WALKER, R.E.,~~

Secretary to Government,

Public Works Department,

Fort Saint George.

SIR,

I have the honour to re-
-port that, in accordance with the in-
-structions conveyed in the Order of
Government No. 1415 A dated 21st
May 1875, I have examined the Panar
Bridge at Buckdohore in company with
the Acting District Engineer, and fur-
-nished that officer with a note con-
-veying my views as to the present
state of the bridge and the works
necessary to secure it for the present
season temporarily, and hereafter
permanently.

2. Dr

2. As the Government have been already informed, the foundations of the bridge were 3 feet of solid work on 5 feet wells. Piers Nos. 1 and 4 have subsided at both upstream and downstream ends; No. 3 at the upstream, and No. 2 at the downstream end only, as evidenced by small cracks in the pier faces; and in addition there has been a settlement of each pier in its entirety, No. 4 to the extent of 6 inches, the others to a lesser extent. The effect on the arches has been as follows: No. 1 arch from the north has a diagonal crack larger at the crown than the intrados, extending from the springing line near the downstream end of No. 1 pier to about same level at the upstream end of the abutment. The two halves however represent

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represent as it were corbelled arches, each complete in itself and sound. The north abutment and No. 2 arch are unharmed. No. 3 arch has followed the pier in this settlement, is much flattened, and slightly cracked in four places at the soffit; the cracks however hardly extend through the thickness of the arch, and for not more than $\frac{1}{3}$ the width of the bridge. No. 4 arch is damaged to about the same extent and in the same manner; both arches have so settled as to cause a very slight separation between their crowns and the upper work. All four arches are I believe safe for ordinary traffic, but as a precautionary measure I have recommended that the roadway be limited over Nos. 3 and 4 arches to 15 feet from the downstream parapet walls.

3. So long as no further subsidence takes place, the bridge may in my opinion be thrown open to the public.

public, but during freshes however small, the various cracks should be examined and repaired on daily, and at other times periodically, by the machine in charge.

4. I am of opinion that eventually the five north arches will have to be rebuilt, the present four piers being removed with their foundations to as great a depth as a good timber coffer dam will permit, and the new piers being built on solid foundations. I fear it will be impossible to found them on cylinders owing to the old walls and debris.

I would then sink two parallel rows of 6 feet cylinders, 20 feet deep, at a distance of 24 feet from the retaining walls, one above, the other below bridge, these rows being connected by two cross rows, one at either bank making the space thus enclosed being floored with concrete or brickwork.

5. J.

5.

To protect for the present the ^{surface of} the sands on which the bridge now rests from further disturbance I have recommended that a layer of rubble 2 feet thick be laid in under the arches where the floor is gone, and that it be laid 2'-1" thick to a distance of 10 feet above and below bridge. To protect the sand beneath from erosion, and the stone itself from slipping beyond the 18 feet line, to the space that will be occupied by new girder cylinders, I have recommended lines of 10 feet whiting piles, the nature of the material being decided by the Acting District Engineer after further enquiry and experiment.

10" X 4 1/2" Hanger plank, which and keel, would in my opinion be best, and it could be withdrawn and used for the well curbs and coffer dams for the permanent work. Casuarina or palm leaf piles would be cheaper but less effective. Should piling prove impracticable, I have recommended that fascine mattresses be made up under each arch, dragged into position, staked down with 12 foot stakes.

Then

these latter being firmly secured to one another with wattling, and the with mesh thus formed, filled with calcareous boulders. The objection to this method is that the future permanent pier will have to be built on a substratum of brushwood, and might I fear settle as the piers decayed, otherwise the tendency of such a mattress to sink at the outer end and follow the scour makes it a very effective protection.

The protection works on the upper side, of whatever material made, will be carried past the first round arch, and finished off parallel and close to the retaining wall, that there may be no set from the piling upon the round will.

To lessen the present lateral tendency of the current I have recommended that the north bank be protected for some 200 to 250 yards by brushwood groynes 20 yards in length,

6 yards apart, laid at an angle of 30° to the bank.

I have also recommended that, as soon as ever the protection work is completed, the large groyne erected to divert the river from the damaged arches be removed, as it must cause a set upon the round arches in the event of a fresh of any size occurring.

I cannot ascertain that there was any greater beach of water, at this bridge, during the recent freshes, than at the inner; and the sufficiency or otherwise of the waterway is so dependant upon the future regulation of the river above that it must be dealt with in the same project. Sea arches can easily be added, if wanted.

From what I have seen and heard, the river may be regarded as completely under regulation at the Tidenmouth weir, and here the volume of water to be dealt with and carried under regulation to the sea may be ascertained.

ascertained. It is, I think, clear that
the river for some miles flows through
banks which offer little more resis-
-tance to erosion than the bed itself,
and the tendency of the river is to
reduce its velocity by widening its
section and reducing the depth;
hence the various old beds, the two Malen-
-tara, the Beryama, and now, others of
recent formation not yet named.
Whenever the banks happen to be of
good stiff clay, as opposite the Chattram
9 miles below the outlet, the bed will
be found level and clean and the
surface falls incessant; where the
banks are almost pure sand, as at
the Railway-bridge site, the sections
show a wide straggling bed, checked
with ridges, and a flattened surface
fall. We have been shown during a
season of comparatively dry seasons,
the river bed has been capable of
passing a fair fresh without the ve-
-locity exceeding that which the bed
and

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and banks will stand; and what this
standard of fresh is may be easily as-
-certained; but directly this is exceeded
erosion of the banks takes place, and
the river splits with nothing to check
it in its course towards the Gadstalam,
a river only 10 miles off lying 30 or
40 feet lower with no dividing watershed.)

The treatment of such a
river ought, it appears to me, to be pre-
-cisely that followed with the Sanjare
river, viz: to maintain river section;
in the combined branches natural and
artificial, sufficient to carry off the
highest known floods with such a
moderate velocity that the banks, pro-
-tected if necessary by graft, may not be
eroded and the "train" of the river
disturbed, and to secure to each branch
its allotted share. That such re-
-gulation is feasible in the Panau Ob-
-servations is plain.

10. The interference with the
river of the last few years has how-

-over in my opinion not only not un-
-der matters, but much aggravated the
swallowing tendencies of the river in
stream. The beryan embankment
has had for its object the exclusion
of the river from two of its flood
outlets, and the forcing of the entire
volume, that has carried by a river
section varying from 17,000 to 18,000
square feet, through a rock-placed
gorge affording with the normal
river depth in floods scarcely 11,000
square feet. This bank has three
times failed; it has this year been
reconstructed of stronger section, and
with additional precautions. It
is impossible to predict the result if
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-spicuous that in a great fresh
on the Arikat the volume forced
through the gorge below would not,
it was thought, be much, if at
all increased, so high were the old
beds

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such as the embankment side; but with
last year's fresh it is not difficult
to show that the call made upon this
reduced section was enormously in-
-creased, and that what might have
been advisable when the bank was in
first design is no longer feasible.
The general opinion among the villagers
and which I asked from several expe-
rienced Department Public Works
engineers is the same, was that in
if the embankment stands the river in
bank must yield elsewhere, with
greater and as there of last year.
However this may be, it appears to me
that the result will clearly be to raise
the velocity in a river where it is
already so great that the banks can
not resist, and to cause fatal slides
and consequent breaches. If I
am not misinformed, the construction
of these sluices to the various
river channels has had or will
have the same effect, and that to a
greater extent than usual, owing
to

to the relative capacities of ^{the} river and its
distributing branches. The mile of
embankment lately thrown up close
to the river edge, however necessary
for the protection of valuable pro-
perty, can have no other result. The
wild effects of these arrangements
have probably been gradual and
cumulative during a succession of
light years, and it requires a full
river to demonstrate them. A much
smaller fresh may however in future
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results, for the main stream was
last year blocked up with the
debris of eroded banks. New flood
cuts were opened by the river in
the direction of the Gualabani
to compensate for this loss of ex-
pansion, and I am informed that
even small freshets last year kept
the line inundated, in other words
the river had cut for itself and
maintained a new ^{deep} bed. These new
cuts

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cuts have now been embanked and
the first full fresh must reopen for
itself a new ^{deep} bed along its old course
at what risk to the banks is well
known.

11. The importance of the early
regulation of this river to the Railway
Company, and therefore to Government,
can hardly be exaggerated. The fun-
dations of a costly bridge of 17 opening
each of 60 feet are commenced, but I
feel convinced that for several years to
come the river will not, in the event of
high freshets, be compelled, in direct
opposition to its own present tendency
to raise the railway at the point pro-
vided for it; and I see no alterna-
tive but for the Company to carry
their line across the valley on a pro-
tected roadway little above paddy fields
level, and to allow the river itself
to pass over it, the raised line
being completed where the river
course is sufficiently permanent to
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permit of its being done.

The discharging capacity of the bridge as at present designed is based on a depth of 10 feet, at a section where the highest flood last year gave a mean depth of something under 7; the reason given being, that secums may be locked for if the river is embanked. I cannot think that such a depth "above present river bed" can ever be reached in this river. On the contrary I believe that its successful regulation is entirely dependent on the maintenance of wide sections, small depths, and low velocities.

12. It was with a view to decide for myself how far the present treatment of the river might be relied upon to secure it in the course bridged for it that I was led to inspect the various branches and to enquire into the past and present history of the river. I

that

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trust that in laying before Government the conclusions at which I have arrived I may not be considered to have transgressed the legitimate scope of the duty I was directed to undertake.

I have the honour to be

Sir

Your most obedient servant

C. Smith Major, R.E.,
Dy. Consulting Engineer for Railways.

Public Works Dept. 23

No 2198.

Proceedings of the Madras Government
Under date the 28 July 1875
Read the following

From
The Deputy Chief Eng. } (C.C. No. - 215th July 1875)
for Railways

Major C. J. Smith's
report submitted with
reference to G.O. 21st May
last, No. 1415 A, deals
with two subjects, viz.
the requirements of the
Ponnaiy Bridge near
Cuddalore and the
circumstances of that
river below the Ponnaiy
Ancient.

Major

P.O. 21 May 1875
13 June 1875-5582
23 June 1875-595-297

RAILWAY DEPARTMENT.
From C.E. No: 4958
The Consulting Engineer,
for Railways,
To
The Secretary to Government,
P. W. Department,
Fort Saint George.
Dated 15th July 1875
Recd. 20th July 1875
No. 2158

S. G. No: 2158. 28-7-75

Regarding the result
of his inspection of the
Ponnaiy Bridge, Cuddalore
- viz, in conformity with
the Act of 1875 -

Dec-22-75
N. H. 12/12/75

2. Major Smith, after detailing the protective works necessary to prevent the fall of the injured arches of the bridge, of which measures he has furnished the District Engineer with notes, states that the 5 arches at the north end with the 4 piers appertaining to them will have to be rebuilt. The protective measures recommended are approved and the District Engineer will report at once what steps he has taken to carry them out and by what

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what date it may be anticipated that the bridge will be safe from further injury and its full water way made available by the removal of the large grogue erected to divert the river from the damaged arches.

3. On the question of increase of water way Major Smith states that a decision should depend upon the treatment of the river above, and on the extent to which other channels than the main line of the river

river may be utilized
to carry water in
heavy freshes. The
opinions he has formed
as to the danger which
will result from ex-
cluding certain old
lines of outfall from
the duty of conveying
their share of flood
water will be fully
considered in deciding
upon the embankment
of the river. In con-
nection with this latter
subject a survey esta-
blishment was sanc-
tioned in G. O. N^o 190,
dated 23^d January 1875,
but as yet no report
on

on the result of the
investigations made has
been submitted. The
District Engineer will
lose no time in sub-
mitting a report. It
appears further that
the extension of the
levee over the country
traversed by the spill
of the Pomioir in
heavy floods and
along the several
courses or by washes
by which at such
times part of the flood
waters is conveyed
will be requisite.
The Railway levee
will no doubt be
of

of use in this connection.

4. The proper treatment of the river will be carefully considered by the Chief Engineer for Irrigation as soon as the necessary data become available.

5. The District Engineer will show on the plan of the bridge the permanent works recommended by Major Smith to be carried out, and as these cannot at present be commenced they will be finally considered and determined upon in the

the light of the discussions which took place on the subject of the arrangements considered desirable for the future security of the Palar Bridge near Vellore. The papers to be submitted should include a survey of the Ponnaiy for several miles above and below the bridge with levels and cross sections so that it may be seen what additional effective waterway can be provided and in

in what position.

26. The construction
of embankments on
the margin of the
river, referred to in
para 10 of Major
Smith's letter, appears
to have been authorized
and seeing that
a comprehensive settle-
ment of the measures
required had been
ordered and provided
for, no work of this
kind should have
been undertaken with-
out the concurrence of
the Chief Engineer
for Irrigation. The

Dist. Engr.

District Engineer ³¹⁷
will show what has
been done, in what
positions and at
what cost, and he
will explain on what
grounds any thing
of the kind has
been carried into

6 Dist. Engr. Subcom.
5 Ch. Engr. for Irrig.
2 Major G. J. Smith R.E.

$$\begin{array}{r} 13 \\ 16 \\ \hline 29 \end{array} \quad \begin{array}{r} 37 \\ 4 \\ \hline \end{array}$$

80 mps 18.8-75

7. The Government approve
of the extension of
Major Smith's investigation
to the river at the mouth of
the river.