

Paper taken out of the Records from the charge of the Referencer.

Press _____
Miscellaneous No. 576P, dated 28-4-90 193

G.O. 24th April 1890 N^o. 577R

Waterways to be
provided on the Illinois
Bureau of Geological
State Railways-

little from the Govt
leaving the ultimate
decision of determining
the — to the local officers
connected with the CR fork system

50

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read again the following paper :—

G.O., dated 12th March 1890, No. 353 R., Public Works.

From the Consulting Engineer for Railways, dated Madras, 8th March 1890, No. 166.

From the Agent, South Indian Railway, to the Consulting Engineer for Railways, dated Trichinopoly, 18th February 1890, No. 254.

I forward, for the orders of Government, the following copy of a report which I have received from the Chief Engineer :—

“ When the Director-General of Railways was at Trichinopoly in November last, I discussed with him the question of the discharges to be allowed for small drainage areas not exceeding 5 miles. The result of that discussion was, I understood, that both he and the Consulting Engineer for Railways to the Madras Government concurred in my view that Dickens' formula for such areas gave results too small and agreed that for areas of one square mile and under a rainfall of 3 inches per hour should be provided, and that for areas above that up to 5 miles the discharge should be fixed at a proportionate between the result so obtained for one mile and that obtained by Dickens' area at 5 miles.

“ I have since been working on these lines, and shall be glad to have a formal record of the approval of Government to the basis then agreed to.

“ The curve which accompanied the Consulting Engineer to Government of India note (dated 6th January 1890) on the Villupuram-Guntakal line was a tentative one only and has not been worked to. I attach a copy of orders I have issued to the staff with reference to this subject and shall be glad of an early answer to this reference.”

2. A copy of the Circular order (No. V.G. 1681, dated 29th ultimo) above referred to accompanies this letter.

ENCLOSURE.

Circular No. V.G. 1681.

The following are the general principles upon which the allowances of bridges and culverts for waterways north of Pakal are to be estimated.

1. For drainage areas of 1 square mile and under, 3 inches of rainfall per hour upon the area drained are to be provided for. This gives a discharge of 1,936 cubic feet per second from an area of 1 square mile.

2. For drainage areas exceeding 1 and up to 5 square miles, the discharges to be calculated proportionately between 1,936 cubic feet per second and 2,759 cubic feet per second, the discharge from 1 and 5 square miles, respectively. The discharge of 2,759 cubic feet per second at 5 square miles is that obtained by the use of Colonel Dickens' formula $D = 825 M^{\frac{2}{3}}$ where—

D = Discharge.

M = Drainage area in square miles.

825 = Coefficient.

Example.—The discharge for an area of 4 square miles would under the foregoing method of calculation be 2,553 cubic feet per second or the mean between the discharges at 1 and 5 square miles, respectively.

3. For drainage areas above 5 square miles, Colonel Dickens' formula ($D = 825 M^{\frac{2}{3}}$) is to be taken.

All formulæ are more or less empirical, but having assumed the basis of rainfall, the elements to be further decided either from a knowledge of the necessary data or by estimation and comparison with other known and similar drainage areas are the velocity and the extent to which the water may be safely headed up.

4. For this information and an intelligent application of formula, the Chief Engineer must in the main look to the officers on the ground who in judging of the extent and nature of waterway required should bear in mind that the formula adopted is intended to provide for the maximum discharge possible from any area, that the character of the catchment will therefore not much affect the question of the quantity to be discharged, for in absorbent ground there is always the possibility of the maximum rainfall occurring when tanks are full and the ground is saturated and when consequently the discharge will be the same, or nearly so, as off a rocky catchment, the principal difference being that the maximum will be more frequently discharged from the latter.

5. With reference to velocities which will vary with the inclination of the country or the bed of the stream and the depth of water flowing over it, attention is directed to the following table of the ascertained effects of different velocities:—

Vide Dubuat.

The safe mean velocities are—

Soft clay and sand, 1 foot per second.

Gravel, 3 feet per second.

Soft rock, 6 "

Rock, from 9 feet per second according to hardness.

By this is meant that the above velocities are such as just do not cause scour.

6. The waterway allowed in drainage works estimated for at head-quarters is as far as practicable calculated on the foregoing formula and considerations, and it is requested that Engineers in making their own proposals or in suggesting alterations in those of others including head-quarters will give fully in detail the reasons and data necessary to justify their proposals and suggestions in either case.

TRICHINOPOLY,
29th January 1890.

(Signed) D. LOGAN,
Chief Engineer.

No. V.G.

True copy forwarded to
District No. for information and guidance, and is requested to acknowledge receipt.

(Signed) H. M. STENT,
for Chief Engineer.

31st January 1890.

Submitted to Government.

2. The Agent's letter and enclosure must go to the Government of India for its orders.

3. Like the Chief Engineer I understood the Director-General of Railways to approve of the provision suggested by the Chief Engineer for areas under one square mile.

4. If any change of principle is desired, orders should be wired by the Government of India.

5. The principle I understood to have been followed on the South Indian Railway prior to the Director-General's inspection is that described in my endorsement No. 360, dated 23rd September 1889.

6. The papers embodied in Proceedings of Government, No. 117 R., dated 21st January 1890, were submitted in order to obtain the confirmation of the Government of India to the principle till then followed.

Order—dated 12th March 1890, No. 353 R., Public Works.

Ordered to be forwarded for the orders of the Government of India.

(Here enter No. 354 R., dated 12th March 1890.)

(True Extract.)

(Signed) C. J. SMITH, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

Endorsement—dated 12th March 1890, No. 354 R., Public Works.

Forwarded.

(By Order.)

(Signed) C. J. SMITH, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

Read also the following paper:—

From Major M. C. BRACKENBURY, Under-Secretary to the Government of India, Public Works Department (Railway Construction), to the Joint Secretary to the Government of Madras, Public Works Department (Railway Branch), dated Simla, 15th April 1890, No. 320 R. C.

I am directed to acknowledge the receipt of your No. 354 R., dated 12th March 1890, forwarding correspondence from the Agent of the South Indian Railway Company regarding the general principles upon which the allowances of bridges and culverts on the Villupuram-Guntakal State Railway are to be estimated.

2. In reply, I am to say that, in forwarding Mr. O'Callaghan's remarks on the formulæ for calculating waterways, the Government of India only wished to draw the attention of the Madras Government to the opinion formed by the Consulting Engineer in the matter; the Governor-General in Council, however, desires to leave entirely to the local officers the ultimate decision as to determining the waterways that should be provided on the Villupuram-Guntakal State Railway.

ORDER—dated 29th April 1890, No. 577 R., Public Works.

Communicated to the Consulting Engineer for Railways with reference to his endorsement No. 166, dated 8th March 1890.

(True Extract.)

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

To the Consulting Engineer for Railways.

Exd. A. Aubert.
Spare Copies

RAILWAY.

Govt. of {1890} Madras.
PUBLIC WORKS.

Dated April, 29th.

Recd.

Encl.

G.O., 29th Apr. 1890, No. 577 R.

APRIL.

**Waterways to be provided on
the Villupuram-Guntakal
State Railway.**

Letter from the Government of India
leaving the ultimate decision of determining
the — to the local officers, communicated
to the Consulting Engineer for Railways.

No. 254.

South Indian Railway,

AGENT'S OFFICE,

TRICHINOPOLY, 18th February 1890.

Recd. again the following G.O. dated 15th March 1890.

From

The AGENT,

SOUTH INDIAN RAILWAY,

To

The CONSULTING ENGINEER FOR RAILWAYS,

MADRAS.

Sir,

I forward for the orders of Government, the
following copy of a report which I have received
from the Chief Engineer:—

"When the Director General of Railways
"was at Trichinopoly in November last, I discussed
"with him the question of the discharges to be allowed
"for small drainage areas not exceeding 5 miles. The
"result of that discussion was I understood that
"both he and the Consulting Engineer for Railways
"to the Madras Government concurred in my view
"that Dickens Formula for such areas gave results
"too small and agreed that for areas of one square
"mile and under a Rainfall of 3 inches per hour
"should be provided, and that for areas above that
"up to five miles the discharge should be fixed at a
"proportionate between the result so obtained for one
"mile and that obtained by Dickens area at 5 miles."

"I have since been working on these
"lines and shall be glad to have a formal record
"of the approval of Government to the basis
"then agreed to."

"The Curve which accompanied the
Consulting

" Consulting Engineer to Government of India State
 " (dated 6th January 1890) on the Villupuram Guntakal
 " line was a tentative one only and has not been
 " worked to. I attach a copy of orders I have issued
 " to the Staff with reference to this subject, and
 " shall be glad of an early answer to this reference."

A copy of the Circular order (No. V.G. 1681
 dated 29th ultimo) above referred to accompanies
 this letter.

I am

Sir,

Your most obedient Servant,

William B. B. B.

Agent.

(1. Encl.)

1/1/90

Dated 18th Feb 1890
 Received 19th Feb 1890
 No. 257
 ENCLOSURE 1

To
 THE CONSULTING ENGINEER FOR
 RAILWAYS,
 Madras.
 From
 THE AGENT,
 South Indian Railway,
 Trichinopoly.

Villupuram Guntakal State Railway
 Chief Engineer's Office.
 Trichinopoly 29th January 1890.

Circular No. V.G. 1681.

The following are the general principles upon which the allowances of Bridges and Culverts for Waterways North of Palk are to be estimated.

1. For Drainage areas of one square mile and under, 3 inches of rainfall per hour upon the area drained are to be provided for. This gives a discharge of 1936 C.f.s. from an area of one square mile.

2. For drainage areas exceeding one and up to 5 square miles - the discharges to be calculated proportionately between 1936 C.f.s. and 2759 C.f.s. the discharge from one and five square miles respectively. The discharge of 2759 C.f.s. at 5 sq. miles is that obtained by the use of Col. Dickens formula $D = 825 M^{3/4}$ where

D = Discharge

M = Drainage area in sq. miles

825 = Coefficient.

Example. The discharge for an area of 4 square miles would under the foregoing method of calculation be 2596 C.f.s. or the mean between the discharges at one and 5 sq. miles respectively.

3. For drainage areas above 5 square miles Col. Dickens formula $D = 825 M^{3/4}$ is to be taken.

All formula are more or less empirical but having assumed the basis of rainfall the elements to be further decided either from a knowledge of the necessary data or by estimation and comparison with other known and similar drainage areas are the velocity and the extent to which the water may be safely headed up.

4. For this information and an intelligent application of formula, the Chief Engineer must in the main look to the officers on the ground who in judging of the extent and nature of waterway required should bear in mind that the formula adopted is intended to provide for the maximum discharge possible from any area, that the character of the

Catchment will therefore not much affect the question of the quantity to be discharged for in absorbant ground. There is always the possibility of the maximum rain fall occurring when tanks are full and the ground is saturated & when consequently the discharge will be the same, or nearly so, as off a rocky catchment, the principal difference being that the maximum will be more frequently discharged from the latter.

5. With reference to velocities which will vary with the inclination of the country or the bed of the stream and the depth of water flowing over it attention is directed to the following table of the ascertained effects of different velocities.

Vide Dubuat. The safe mean velocities are

Soft Clay
and Sand } 1 ft per sec.

Gravel... 3 ft per sec.

Soft Rock... 6 ft per sec.

Rock... From 9 ft per sec. according to hardness.

pro luc 2
26/2/90

By this is meant that the above velocities are such as just do not cause scour.

6. The waterway allowed in drainage works estimated for at Head Quarters was as far as practicable calculated on the foregoing formula and considerations, and it is requested that Engineers in making their own proposals or in suggesting alterations on those of others including Head Quarters will give fully in detail the reasons and data necessary to justify their proposals & suggestions in either case.

Signed, David Logan.
Chief Engineer

A. V. G.

True Copy forwarded to
Executive Engineer District No. _____ for information
and guidance, & is requested to acknowledge receipt.

M. S. S.

For Chief Engineer

31st January 1890.

initialed

Letter from the Agent,
South Indian Railway, No: 254,
dated 18th February 1890, with
enclosure.

No. 166

SUBMITTED _____ To _____ Government.

2. The Agent's letter and enclosure must go to the Government of India for their orders.

3. Like the Chief Engineer I understood the Director General of Railways to approve of the provision suggested by

by the Chief Engineer
for areas under one
square mile.

4. If any change
of principle is desired
orders should be wired
by the Government of
India.

5. The principle
I understood to have
been followed on the
South Indian Rail-
way prior to the Di-
rector General's in-
spection is that des-
cribed in my endos-
ment^{ch} 360, dated 23rd
September 1889

6. The papers em-
bodied in Proceed-
ings of Government
No. 114 R, dated 21st Ja-
nuary 1890 were
submitted in order
to obtain the con-
firmation of the
Government of In-
dia to the principle
then followed.

Wm. R. R.
Genl. Secy. for G.O.

B. No. 353 R of 12th March/90

Ordered to be

forwarded for the orders
of the Government of India.

From

THE CONSULTING ENGINEER
FOR RAILWAYS,

MADRAS,

No. 166.

Dated

Received

8th } March 1890.
13 }

No. of ENCLOSURES. 2

A. C. No. 354 R of 12th March 1890.

Forwarded.

C.S.

8. 9/90

R.

2/3/90.

Subject.
B. No. 353-54 R of 12th March/90.

Submitting to Government letter
from the Agent, South Indian
Railway, (with enclosures) re.
discharges of waterways on
the Villupuram - Guntakul
Railway.

P.W.C. No. 2622.

Recd. also the following paper:-

No. 320 R. C.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY Construction.

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

Simla, the 15th April 1890.

Sir,

I am directed to acknowledge the receipt of your No. 354 R. dated 12th March 1890 forwarding correspondence from the Agent of the South Indian Railway Company regarding the general principles upon which the allowances of bridges and culverts on the Villupuram - Guntakul State Railway are to be estimated.

2. In reply I am to say that in forwarding Mr. O'Callaghan's remarks on the

All communications
should be addressed
to the Secretary.

the formulae for calculating waterways,
the Government of India only wished
to draw the attention of the Madras
Government to the opinion formed by
the Consulting Engineer in the matter;
the Governor General in Council, how-
ever, desires to leave entirely to the local
officers the ultimate decision as to
determining the waterways that should
be provided on the Villupuram Guntakal
State Railway.

I have the honour to be,

Sir,

Your most obedient servant.

W. Mackenzie

Major, R.E.,

G.O. No. 117 R 21 Jan'y 90.

Under Secretary.

" " 353-54 R. 12th March 90.

" " 181 R. 2. 2. 90. Confidential.

Idors

Documents accompanying

Nil

23/4

P.W. No. 3846

No. 547 R.

PUBLIC WORKS DEPARTMENT,
RAILWAY BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 29th April 190.

again
Read the following

Procs. of the Madras } H.E. No. 353-54 R 27/12th March 90
Govt. P.W. Deptt. -

Read also the following:-

Letter from the Govt. } H.E. No. 320 R.C. 4/18 April 90
of India P.W. Deptt. -

Also
26 April.

Communicated to
the Consulting Engineer for
Railways with reference to
his endorsement No. 166 dated
8th March 1890. -

Pueon

25.4.90 W

for R

To

The Cons'g. Engr for Rys.

A
No. 547 R of 29 April 190

No. 2574. R 28.4.90

Recd 5/5.