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Public Works Department.

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No. 180 W

Dated 17th January 1896.

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No 47 Marine of 24th Jan 1896

Communicated
to the Presidency Secy
officer.

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SUBJECT.

Lightning Conductor at
Sanzapally: —

Communicating Copy
of a report on the
by Sergt. Cornwell.

Shes. S. O. ✓

S. S.

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Marine

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Read the following

Report on Inspection of Lightning Conductor
made by Sergeant F.W. Cornwell, Supervisor, P.W.D.,
on 26th Nov 1895.

Test was made in dry weather with a
Bucknill's Balance and 4 cells Leclanché.

The main Conductor is a single pointed
Copper rod platinum-tipped which rises from
the masonry Platform, on which the lantern is
constructed, against a masonry shaft built to
support the Conductor. The upper terminal is
some 4 or 5 feet higher than the finial on the top of
the Lantern cupola; it consists of a Copper-rod which
is fastened into a $1\frac{1}{2}$ " Copper tube which runs down
the N face of the shaft above referred to and forms
the Conductor to ground line. This tube is connected
with a 1-2" Galvanized Iron wire rope which forms
the Conductor from the base of the Light house tower
to the "Earth".

The "earth" is a copper plate 3 ft Sq: buried
in a well at the foot of the hill on which the
Light house Tower is constructed and about
250 ft from the platform.

I am informed by the Light house
Keeper

hook & the
 well 15 ft deep
 plate is a permanent water seal, but
 Conductor is in good order and the resistance low
 the earth was not dug up or disturbed. For this
 reason it is not known how the Copper plate is
 connected to the Iron wire rope.

The Copper tube forming the Conductor ^{note: & better}
 from top to ground line is joined to the wire ^{forming in same}
 rope, by fraying out the end of the rope dropping ^{in Chap. III para 2}
 in the tube and splicing the wire rope round it. ^{Manual above}

This is also on the same authority. As this joint
 is in the masonry of the platform, and could
 not be examined without breaking up the
 masonry, a proceeding which was unnecessary
 as the Conductor was found to be in good order.

As there was only 1 "Earth" available, 2 auxiliary ^{See manual of}
 earths were laid in the usual manner for pur- ^{Instructions on test}
 poses of the test. These were laid on the S. side ^{lightning conductor}
 of the light house remote from the Conductor earth ^{circulated under}
 and from each other. The leads used were ^{Chief Engineer's Co.}
 of Cotton-covered Copper wire, and gave a resis- ^{29.45 C of 10-67}
 tance before and after testing of 2 ohms. The readings ^{Chap. II § 2.}
 recorded were as follows:—

x represents Conductor Earth
 y " " Auxiliary Earth
 z " " the other do.

x and y in Circuit gave a mean Resistance = 130 ohms
 y + z " " " = 255 "
 x + z " " " = 135 ohms

Whence $x = \frac{1}{2} \{ 130 + 135 - 255 \} = \frac{1}{2} \{ 265 - 255 \} = 40 \text{ ohms}$

which may be considered fairly good—the ^{x see above quoted}
 maximum Resistance admissible being 10 ohms. ^{Manual Chap. III para 29.}

The

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The Resistance from top of terminal to ground line was "nil".

A 2nd terminal has recently (1892) been
 erected on the roof of the office, which is on the
 same platform as the lantern and adjacent to it.

In the centre of the office roof (terrace)
 an iron tripod some 10 ft. has been erected to
 support this conductor. The terminal is a piece
 of $\frac{1}{2}$ " round Copper rod, round the foot of which
 is twisted a copper tape $1" \times \frac{1}{8}"$. This tape is twisted
 spirally round 1 of the legs of the conductor, comes
 to the roof and passes Nwards and horizontally
 along the roof, then vertically down the wall
 to the level of the platform, then takes a right
 angled bend northernwards along the platform
 about 6 feet then turns again at right angles
 and passes Eastwards and joins the main
 Conductor.

There are several objections to this
 Conductor. In the first place the primary obj-
 of a Conductor is to provide an easy path to earth
 for an electrical discharge. To this end all
 sharp bends should be avoided and the
 Conductor should be brought to earth by the most
 direct available outside the building to be
 protected. It is I consider extremely improbable
 that an electric flash if it ^{did} strike this
 terminal, would follow the tortuous ^{path} described
 by this Conductor.

The necessity of this 2nd terminal
 is not very apparent. It was probably erected
 on

Chapter III para 5
 Manual of
 instructions

on the principle that a conductor protects a space included in a cone having the point of the terminal for its apex and a base whose radius equals the height of the rod above ground, or in other words protects everything within an angle of 45° from the top of the lightning rod.

This principle is not acted upon now.

At the Power station of the Madras Electric Tramway Company is a high shaft 10 ft which forms the chimney for the boiler furnaces. A lightning conductor was fixed to this last year. This chimney is 5 feet wide at top and it would have been very easy to apply the principle of the cone to this as it would have needed only a rod 6 ft above the level of the chimney top. The rod actually fixed rises some 2'-6" above the chimney top on its outer face. As this was fixed presumably by specialists, I enquired of the Electrical Engineer in charge, why this was not raised higher. He explained that a conductor had a ^{considerable} "sparking" power or power of attracting a flash and that of the principle of the cone was erroneous. Again in terraced roofed buildings of considerable extent e.g. the General Hospital Madras, the application of this principle of the cone would necessitate the erection of many hundreds of rods on a single building.

On the whole although this 2nd terminal is in electrical contact with the main conductor I should consider the building better protected without it.

Endorsement

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Endorsement thereon by the Supty. Engineer, P.W.D. No 664. V.L., dated 20-12-95.

With reference to G.O. no. ^{2619W}/₂₄₋₁₀₋₉₅, I have the honour to submit copy of a report by Sergeant Cornwell who recently tested the lightning conductor at Santopilly.

2. As pointed out by Sergeant Cornwell the conductor for the office seems rather a source of danger than otherwise and I think it would be advisable to remove it.

Order thereon: No: 180 W of 17th January 1896

Communicated to the Marine Department with reference to para 4 of G.O. no. 288 Marine dated 2nd October 1895.

(True extract)

C. R. Burton
Under Secretary to Government
Public Works (Marine) Dept.

The Marine Department