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IMPLEMENTATION OF FIBER OPTIC COMMUNICATION IN CEB TRANSMISSION NETWORK

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

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I endorse the declaration by the candidate.

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Abstract

It is advantages to change over from Power Line Carrier (PLC) communication presently used in Ceylon Electricity Board (CEB) to optical fiber communication to serve the increasing communication requirements (voice & data) with power system expansion in progress.

As a first step, CEB has added one Optical Fiber Ground Wire (OPGW) with twenty four optical fibers to all new lines constructed after year 2000. It was identified that the incorporation of optical fibers to selected lines linking generation stations and grid substations to System Control Centre (SCC) can make the backbone optical fiber communication network.

Thirty numbers of transmission lines of total length 562.1 km can link all important generation stations and grid substations to SCC of CEB and those lines were selected to incorporate optical fibers for stage 1 communication network of this study.

Optical fibers manufactured to different standards are available in the market. It was found that the optical fibers manufactured to the standard ITU-T-G.652 is the best for the stage 1 communication network.

The replacement of one shielding wire by OPGW is the best method to incorporate optical fibers to CEB transmission lines, out of the different methods used in the world to incorporate optical fibers to overhead lines. It is beneficial for CEB to select a single OPGW type to replace all types of ground shielding wires in transmission lines selected for stage 1 communication network. OPGW types available in the market with overall diameter 11.80 mm, ultimate tensile strength 68.0 KN and tube (to enclose the fibers) made of stainless steel with aluminum clad was selected as the best suited OPGW for this purpose.

Practical problems and cost associated with power outages proved that the live-line stringing is more economical for the lines selected for stage 1. Supply and live-line installation cost of OPGW for stage 1 is 7,796 USD/km (805,716 LKR/km, as per the present exchange rate) and it is 15.6 % higher than the supply and dead-line installation cost of the same. Further, it was found that the addition of one OPGW mentioned above to new 132 kV double circuit Zebra lines is only 3.2 % of the total construction cost of the line. Therefore, adding one OPGW to all new transmission lines to be constructed in CEB is justifiable.

There is a good opportunity for CEB to enter into a communication business using the extra fibers available with its transmission network which covers all populated areas of the inland. However, it is to be studied in detail before entering to this challenging business.

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