EVALUATION OF LIGHTNING AND GROUNDING SYSTEM DESIGN IN HIGH VOLTAGE SUBSTATION

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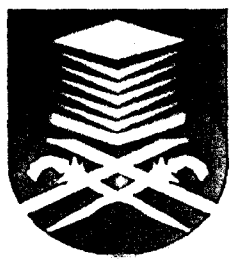

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ABSTRACT

Substation is a part of component that grants the successful of operation in power system. In general, it can be considered as heart of overall power system. Well-designed grounding plays an important role in every substation. As lightning strike on transmission tower, the high current should be directed to ground in proper manner. Thus, grounding system has to be design with safe as it is especially concerned with safety of persons working within the substation, equipment's and it surrounding with hazardous of step and touch voltage. The main purpose of this paper is designing safe grounding systems with cost effective for HV (High Voltage) substations situated at such locations where soil of the substation site is not uniform. Next, two case study have been solved by using computer program package CDEGS (Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis), Autogrid Pro and results obtained here are compared with manual calculation. Possible design improvements are introduced and compared for their effectiveness from safety and cost efficiency perspectives.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Power demand of the modern cities keeps growing year by year result to a compulsory and necessary to establish new high voltage substations to satisfy power demand in densely populated urban areas [4]. The area available for installing high voltage substation is limited and becomes more and more expensive in the city. Thus, this situation requires optimum performance of earthing resistance at the substations area to satisfy the safety including step voltage, touch voltage and earth resistance.

Substation grounding design considerations are important to ensure the safety of personnel and the public, to minimize hazard from transferred potential, to protect equipment insulation, to provide a discharge path for lightning strikes, and to provide a low-resistance path to ground [1]. A good grounding system provides a low resistance to remote earth in order to minimize the ground potential rise (GPR). For most transmission and other large substations, the ground resistance is usually about 1 Ω or less [4].

The calculations of the step voltage, touch voltage, GPR, and grounding resistance, are based on IEEE Std. 80 – 2000 via commercial tool, CDEGS (Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis) Software, AutoGrid Pro.[11]. Very simple approach of iterative search to plan the optimal grounding grid, which includes number of unilateral mesh size and depth of the grounding grid conductors were studied and investigated.

In order to achieve all safety parameter mentioned before, the specific method and technique of grounding system design should be applied accordingly with consideration on cost and performance.