

A Study on Wind Resistant Design Considering Directional Wind Characteristics for Transmission Lines

T. Ishikawa*1 , S. Matsuura *1 and H. Nakamura*2
*1 CRIEPI, Japan, *2 Hiroshima University, Japan

Abstract

High-voltage transmission lines with an overall length of several hundreds kilometers have been constructed across the mountainous area or the coastal zone, and directional strength characteristics of the transmission lines are found remarkably due to a high rate of wind load. Since the wind load is critical for transmission lines, it is important to assess the design wind speed and wind load reasonably at construction sites. Transmission towers are considered to be designed with enough wind-resistant performance, however, it is necessary to re-examine the current estimation methods from both points of design wind speed and wind load to rationalize the tower design and to improve the structural integrity.

For the rationalization of wind resistant design for transmission lines, wind resistant rationalization committee (FY1999-FY2001), organized by Central Research Institute of Electric Power Industry (CRIEPI), promoted the studies on directional basic wind speed and equivalent static wind load with electric power utilities. In this committee, we proposed the directional basic wind maps showing the 150-year return period of annual maximum 10 minutes-mean wind speed based on the observed data at about 140 meteorological observatories in Japan and typhoon simulation results. Furthermore, we developed the numerical simulation method for estimating design wind speed with topographic effects. In addition, in order to utilize directional design wind speed, the accurate wind load evaluation for every wind direction is needed. Namely it is important to consider the dynamic effects of the tower-conductor systems, such as scale and resonance effect, as well as the wind speed influenced by topography and the wind direction. For this purpose, we also proposed the wind load considering the dynamic effects based on the gust effect factor method and the reduction coefficients to estimate the influence of non-simultaneity between towers and conductors.

The purpose of this paper is to describe the summary of the investigation results of the wind resistant rationalization committee and to show the outline of "Recommendations for wind loads on transmission towers - a draft (2002)", which was based on these results.