The 2024 World Congress on
Advances in Civil, Environmental, & Materials Research (ACEM24)
19-22, August, 2024, The K hotel, Seoul, Korea

Investigation into the failure mechanisms of overhead transmission lines under combined wind and ice

*Xiangrui Meng[1)], *Li Tian[2)] , Juncai Liu [3)] and Kunjie Rong [4)]

[1), 2), 3), 4)] *School of Civil Engineering, Shandong University, Jinan 250061, Shandong, China*
[2)] tianli@sdu.edu.cn

ABSTRACT

Failure behaviors such as line breakage, wind deflection, insulator failure, and tower collapse can occur in overhead transmission lines (OTLs) under combined wind and ice. Studying the types of failures prone to occur can inform the design of OTLs. Therefore, this paper proposes a comprehensive framework for evaluating the performance of OTLs under combined wind and ice, accurately calculating the occurrence probability of each failure type. First, a high-fidelity numerical model of the OTL is established, and different components are classified into performance levels based on design requirements. Then, the response characteristics of OTLs, insulators, and towers are investigated by simulating various wind-ice joint working conditions. Finally, probabilities of line breakage, wind deflection, insulator failure, and tower collapse are computed. Example analyses demonstrate that the thickness of the ice cover significantly influences the probability of each failure type. Specifically, the probability of wind deflection decreases with increasing ice cover thickness, while the probabilities of line breakage and tower collapse increase.

REFERENCES

Wang, J., Li, H. N., Fu, X., Dong, Z. Q. and Sun, Z. G. (2022). Wind fragility assessment and sensitivity analysis for a transmission tower-line system. *J. Wind Eng. Ind. Aerod.*, **231**, 105233.

Wang, D., Guo, H., Shen, Q., Feng, C. and Li, Z. (2022). Experimental Investigation and Estimation of Wind Load and Wind-Induced Responses of Monopole Three-Sided Billboard. *J. Struct. Eng.*, **148**(5), 04022042.

[1)] Graduate Student
[2)] Professor
[3)] Ph.D.
[4)] Ph.D.