

CIGRE Study committee B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG B2.101

NAME OF THE CONVENOR

Labocha Slawomir (POLAND)

TITLE

Update on the uplift resistance capacity of overhead line foundations

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION

4 / Sustainability and Climate Change

5 / Grids and Flexibility

POTENTIAL BENEFIT OF WG WORK

2 / potential interest from a wide range of stakeholders

3 / likely to contribute to new or revised industry standards

5 / Guide or survey on techniques, or updates on past work or brochures

STRATEGIC DIRECTION

2 / Making the best use of the existing systems

3 / Focus of the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)

SUSTAINABLE DEVELOPMENT GOAL

7 / Affordable and clean energy

9 / Industry, innovation and infrastructure

BACKGROUND :

The publication of CIGRE Report 22-06 (1968), “the use of soil mechanics methods for adapting tower foundations of soil conditions” by Jean Biarez and Y. Barrand, well known as the “Grenoble method”, was a turning point in the calculation of tower foundation uplift resistance, applying rigorous soil mechanics principles into transmission line design. Since then, millions of OHL foundations have been designed and installed with very good results.

However, significant changes have occurred since that time, both in environmental conditions and in technological development.

On one hand, many new tools, techniques and computational methods have offered to the designer new possibilities for structural modelling, including powerful software for structural analysis.

On the other hand, climate changes are increasing dramatically the frequency and intensity of extreme weather events, including storms, lightning, heavy rainfall, and wildfires.

Transmission lines are generally vulnerable due to their extensive geographical coverage and exposure to diverse environmental conditions. In this context, they are particularly sensitive to the meteorological, climatological and hydrological events.

From the perspective of OHL foundations, these climatic events have had significant impacts on their resistance capacity.

To integrate renewable energy sources and meet increasing electricity demand, utilities are facing major challenges and significant pressure to increase power-transfer capability and extend the life of existing overhead transmission lines.

As noted earlier, climate change is placing growing stress on overhead transmission lines. More frequent and intense events—such as heatwaves, high winds, icing, and flooding—are exposing the limits of traditional design

standards and contributing to infrastructure failures.

Regarding OHL tower foundations specifically, these climatic events have had substantial impacts on their resistance capacity. Foundations are now subjected to higher loads and increasingly adverse soil conditions, particularly due to hydrological events such as flooding.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The main objective of this Working Group is to evaluate how predictions of uplift resistance for overhead transmission-line foundations have evolved, and to assess how these foundations respond to climate-related impacts.

SCOPE :

The proposed Working Group will focus on points of interest about foundations as described above, with the aim of providing responses primarily to the following issues:

1 – Overview of the design and construction of different foundation types.

A questionnaire is expected to be issued.

2 – Current state of knowledge in assessing the uplift load capacity of foundations

- a. Review of the literature
- b. Review of calculation methods
- c. Basics of calculation methods:
 - Pull-out cone methods
 - Lateral pressure methods
 - Testing supported methods
 - Standard calculation methods
 - Analytical methods
- d. Finite element method

3 – Review of field tests in the assessment of uplift load capacity

- Research methodology
- Field archival research

4 – Uplift tests already carried out on “mushroom foundations”

5 – Analysis of the Working Group's own research results

6 – Limit analysis methods for calculating pull-out (uplift) capacity

- Method assumptions
- Axisymmetric mushroom foundation
- General cohesionless soil (coarse-grained)
- General cohesive soil (fine-grained)
- Special foundation with a non-circular projection
- Comparative analyses

Remarks:

The WG will rely on all available literature, with particular emphasis on CIGRE Reports and Technical Brochures.

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
Technical Brochure and Executive Summary in Electra
Tutorial

Time schedule

Q2	2027	Recruit member (National Committee)
Q4	2027	Develop final work plan
Q4	2027	Annual progress and activity report to Study Committee
Q4	2028	Draft TB for Study Committee Review
Q4	2029	Final TB

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Loken
October 20th, 2026



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