





# Construction of

## 220 kV Loop in Loop out Paliastomi- into Ozurgeti Substation and

### 110 kV Double Circuit (D/C) Overhead Line from Ozurgeti Substation to Zoti HPP

## DESIGN CRITERIA FOR TOWER FOUNDATIONS

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## 1 Foundations

Foundation design is in comply with adherence to Section 2.5 of Particular Technical Requirements and the design standard is according to EN 50341-1:2012, Section 8.

Action forces acting on tower are transmitted to foundations taking account of the actual leg configuration. The partial factors for actions shall be in accordance with the Technical Specification, 3.1.

Partial factors for actions ( $\gamma_F$ )	Data
For permanent actions: dead weight of conductors, OPGW, insulator sets, towers, for all loading cases ( $\gamma_G$ )	1.1 (when stress increasing) and 1.0 (when stress decreasing)
For variable actions / climatic loadings: wind( $\gamma_W$ ), ice ( $\gamma_I$ ) and conductors tension ( $\gamma_C$ ), for towers, foundations, insulators, hardware and fittings, applicable as following:	
For normal loading cases N1...N5: $\gamma_W$ , $\gamma_I$ , $\gamma_C$	1.35
For exceptional loading cases E1, E2: $\gamma_C$ , $\gamma_I$	1.1
For construction and maintenance loading case E3: $\gamma_W$ , $\gamma_C$	1.5
For dynamic stringing loading: $\gamma_C$	2


Partial factors for foundation material are in accordance with Technical Specification 3.2.2:

Foundations:	Data
Compressive concrete strength	1.5
Compressive concrete strength for prefabricated parts	1.4
Reinforcement steel	1.2
Soil properties	As per EN 1997-1

The Contractor will be performed investigations as a minimum, two activities (borings, Cone Penetration Tests (CPT) or trial pits) at all line angle point locations and additionally, at sufficient locations between the angle points depending on the terrain and geology, but not more than 1.5 km apart.

Three types of concrete foundations (block, pad and chimney with undercut and without undercut) shall be used in conjunction with 5 preliminary adopted soil classes specified in the Technical Specifications which will be confirmed or changed according to final test results.

In case that we found the soil characteristic "unknown" i.e. characteristics impossible to resolve using any of 3 foundation types proposed, a special foundation type will be done for that location.

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<b>Foundations</b>	<b>Unit</b>	<b>Data</b>
<b>Type 1 – Sound rock</b>		
• Density	kN/m <sup>3</sup>	25
• Soil pressure	kN/m <sup>2</sup>	1000
• Angle of frustum	[°]	25
<b>Type 2 - Deleterious rock</b>		
• Density	kN/m <sup>3</sup>	20
• Soil pressure	kN/m <sup>2</sup>	500-1000
• Angle of frustum	[°]	25
<b>Type 3 - Good Soil</b>		
• Density	kN/m <sup>3</sup>	17
• Soil pressure	kN/m <sup>2</sup>	300
• Angle of frustum	[°]	22
<b>Type 4 - Normal Soil</b>		
• Density without ground water	kN/m <sup>3</sup>	18
• Density with ground water	kN/m <sup>3</sup>	10
• Soil pressure	kN/m <sup>2</sup>	200
• Angle of frustum	[°]	15
<b>Type 5 - Poor Soil</b>		
• Density without groundwater	kN/m <sup>3</sup>	16
• Density with groundwater	kN/m <sup>3</sup>	8
• Soil pressure	kN/m <sup>2</sup>	80
• Angle of frustum	[°]	0
<b>Backfill</b>		
• Density (compacted)	kN/m <sup>3</sup>	16
• Angle of frustum	[°]	15

- Rock foundation– on rocky grounds, soil class 1 & 2
- Light pad and chimney foundation - for good & normal soil, soil classes 3 & 4
- Heavy pad and chimney foundation - for normal soil submerged, soil class 5.

The chimney height adopted is 50cm ≥ 30cm imposed by Technical Specifications.

Foundations will be executed “In Situ” according to forces and soil type for each tower location.

In case of numerous foundations placed in sound rock, foundation type with rock anchors can be used instead of rock foundation.