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NB

**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 35082-2016

**Technical code for eco-restoration of vegetation concrete on
steep slope of hydropower projects**

水电工程陡边坡植被混凝土生态修复技术规范

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Table of Contents

1 General provisions	1
2 Terms	2
3 Basic data	3
4 Drainage	5
5 Irrigation	7
6 Reinforcement	8
7 Vegetation	10
8 Vegetation concrete	12
8.1 Materials	12
8.2 Proportioning	13
8.3 Spraying	15
9 Construction	18
9.1 Construction preparation	18
9.2 Construction procedure	18
10 Maintenance and management	20
10.1 Seedling stage	20
10.2 Growth stage	21
11 Inspection	22
11.1 Material	22
11.2 Vegetation concrete	23
Appendix A Investigation contents and record formats of basic data	24
Appendix B Receiving reports of construction processes	29
Appendix C Inspection contents and record formats of main materials	32
Appendix D Inspection contents and record formats of vegetation concrete	37
Explanation of wording in this code	38
List of normative standards	39
Addition: Explanation of provisions	41

Foreword

This document was issued on 16 August 2016 by the National Energy Administration of the PRC and takes effect on 1 December 2016.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 27.140, Chinese classification P59.

This code was formulated in accordance with the requirements of the Notice of the National Energy Administration on Issuing the First Batch of Energy Sector Standard Formulation (Revision) Plans for 2014 (Guo Neng Ke Ji [2014] No. 298). The drafting group carried out extensive investigation and research, carefully summarized practical experience, referred to relevant domestic standards and advanced foreign standards, and formulated this code on the basis of widely soliciting opinions.

The main technical contents of this code are: basic data, drainage, irrigation, reinforcement, vegetation, vegetation concrete, construction, maintenance and management, and inspection.

The National Energy Administration is in charge of the administration of this code. China Renewable Energy Engineering Institute proposed it and is responsible for its routine management, and the Energy Sector Standardization Technical Committee for Hydropower Planning, Reservoir and Environmental Protection is responsible for the interpretation of its specific technical contents. Comments and suggestions arising during implementation should be sent to China Renewable Energy Engineering Institute (Address: No. 2 Liupukang Beixiaojie, Xicheng District, Beijing; Postcode: 100120).

Chief development organizations of this code: China Three Gorges University; China Renewable Energy Engineering Institute.

Participating development organizations: Soil and Water Conservation Plant Development and Management Center of the Ministry of Water Resources; Sinohydro Bureau 7 Co., Ltd.; PowerChina Kunming Engineering Corporation Limited; China Gezhouba Group Three Gorges Construction Engineering Co., Ltd.; China Gezhouba Group Survey and Design Co., Ltd.; China Gezhouba Group No. 6 Engineering Co., Ltd.; China Gezhouba Group Foundation Engineering Co., Ltd.

Announcement of the National Energy Administration

Announcement 2016 No. 6: In accordance with the relevant provisions of the Notice of the National Energy Administration on Issuing the Administrative Measures for Standardization of the Energy Sector (Trial) and the Implementation Rules (Guo Neng Ke Ji [2009] No. 52), and upon review, the National Energy Administration approved 144 sector standards, of which 75 are energy standards (NB) and 69 are electric power standards (DL), and hereby issues them.

In the attached list of sector standards, NB/T 35082-2016 appears as item 32, with no standard superseded, approved on 2016-08-16 and implemented from 2016-12-01.

1 Scope

NB/T 35082-2016 is the Chinese technical code for eco-restoration of steep slopes on hydropower projects using vegetation concrete. Hydropower construction leaves behind large bare rock and soil faces - cut slopes at dam abutments, spillway and powerhouse excavations, quarry faces and road cuttings - that are often between 45 and 85 degrees, too steep for ordinary soil to stay on and too exposed for plants to establish. Vegetation concrete is the answer the code describes: a sprayed mixture of planting soil, a small proportion of cement, organic matter, a green additive that corrects the alkalinity the cement introduces, and seed, anchored to the slope with mesh so that a growing medium stays in place long enough for roots to bind it. The code sets the general provisions and defined terms, then the site investigation of slope geometry, rock type, stability, climate and native plant species. It covers the design of the treatment: the classification of slopes into hard rock and soft rock, the thickness of the base and surface layers, the mix proportions with their formulas and coefficients, the anchoring and mesh system, and the selection of plant species. Materials and their quality requirements follow, then construction - surface preparation, anchor installation, mixing, spraying, seeding and curing - and the maintenance and monitoring of the vegetation. Acceptance criteria and evaluation of the restored slope close the code.

1.0.1 This code is formulated with a view to standardizing the design and construction of eco-restoration works using vegetation concrete on steep slopes of hydropower projects.

1.0.2 This code is applicable to stable slopes of hydropower projects with a slope gradient of 45 degrees to 85 degrees, and may also be used for similar slopes of other projects.

1.0.3 Eco-restoration with vegetation concrete shall be carried out on the basis of the safety and stability of the slope, and the slope stability shall take into account the additional loads and effects imposed on the slope body by the vegetation concrete eco-restoration works.

1.0.4 Eco-restoration with vegetation concrete on steep slopes of hydropower projects shall follow the principle of sustainability.

1.0.5 Eco-restoration with vegetation concrete on steep slopes of hydropower projects shall comprehensively consider factors such as hydrological and meteorological conditions, slope conditions, vegetation, construction conditions and project investment, adapt measures to local conditions, and ensure rational design, careful construction and strengthened maintenance and management.

1.0.6 Slopes are classified into four types, namely hard slopes, soft slopes, soil-rock mixed slopes and infertile thin soil slopes, and different types of slopes shall be treated differently.

1.0.7 In addition to this code, eco-restoration with vegetation concrete on steep slopes of hydropower projects shall also comply with the relevant current national standards.

2 Terms

2.0.1 vegetation concrete: A mixture made by mixing planting soil, cement, organism of habitat material, amendment of habitat material, plant seeds and water. It features strong resistance to scouring, high fertility and a rational distribution of the solid, liquid and gas phases, and is a typical habitat material.

2.0.2 organism of habitat material: A granular substance used as an ingredient of vegetation concrete, made from several kinds of natural organic materials such as farmyard manure, straw, rice husk, sawdust and distillers' grains, after processing by crushing, blending, stacking and fermentation.

2.0.3 amendment of habitat material: A fine granular substance used to improve the physical and chemical properties of vegetation concrete, such as its microbial environment and pH value, fertility, water retention and structure.

2.0.4 watershed of slope crest: A water collection area set between the intercepting ditch at the slope crest and the upper edge of the restored slope surface, in order to supply ecological water for the slope plants.

3 Basic data

3.0.1 Before project design, the basic data of the project area shall be investigated to obtain information on meteorology, geology, water sources, topsoil resources, natural organic materials and plants.

3.0.2 The investigation of meteorological data shall mainly cover the zone type, climate type, multi-year average annual sunshine hours, multi-year average air temperature, extreme maximum temperature, extreme minimum temperature, multi-year average annual precipitation, multi-year average annual evaporation, frost-free period, freezing period, effective accumulated temperature of not less than 10 degrees C, and wind speed; it should be based mainly on the collection and analysis of data, supplemented by necessary field investigation.

3.0.3 The investigation of geological data shall mainly cover the rock and soil type of the slope, slope area, slope aspect, maximum slope gradient, maximum vertical height, groundwater conditions, seepage on the slope surface, stability of the slope body and slope shape; it should be based mainly on the collection and analysis of data, supplemented by necessary field investigation.

3.0.4 The investigation of water source data shall mainly cover the types of water sources such as tap water, well water and river or lake water, together with their water supply capacity, distance, head difference and cost of use; it should be based mainly on field investigation, supplemented by data analysis.