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Concrete towers out of semi-precast elements - erection of a prototype tower section

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Abstract

The further the transition from fossil to renewable energy generation is advancing the more wind turbines are build. Cites on-land with high wind speeds get more and more exploited, therefore cites with moderate and low wind speeds are getting more often in the focus for a wind turbine erection. At such cites, turbines need bigger rotors and higher towers in order to generate economical energy. That is why new construction methods for higher towers are of interested. Therefore, a new tower erection procedure was invented. The method is characterized by the use of standard and plain double wall elements, which are available all over the world. These elements are assembled to load bearing segments. The segments are stacked over each other as long as they are hollow and the hollow core of the double walls is filled with concrete, whereby all joints are reinforced therefore a monolithic and continuously reinforced tower structures is gained. Such a tower can be erected fast, while providing a structural resistance similar to a cast-in-place structure. The method was already tested in the erection of a prototype tower section where it demonstrated its practical feasibility.

Keywords: precast; double walls; high towers; wind turbine

1 Introduction

Horizontal axis wind turbines opened up a new field of application for tower structures. As wind turbines operate until a certain maximum wind speed, hub heights of 80 m till 100 m reached by tubular steel towers where reasonable for cites with high wind speeds. The progressive expansion of wind turbines led to the erection of wind turbines in low-wind areas.

If electrical energy shall be generated competitive, then towers have to become higher at low-wind cites. Because with rising height the possible rotor diameter and therefore captured air volume rise as well as the wind speed is rising while wind speed fluctuations are getting smaller. This trend led until now, to the erection of wind turbines with a hub height of 164 m [1].

For higher towers new concepts were developed in order to stay economical. One of the most successful ones are hybrid towers out of precast concrete rings at the bottom and tubular steel segments on top. Whereby, if the same building materials are used, precast towers out of solid elements usually provide a smaller structural resistance [2] respectively require more prestressing [3] than cast-in-place towers erected by slip or climbing formworks. Nevertheless, cast-in-place towers are rarely erected because of their rather slow erection process where 4 to 5 m tower height can be produced per day. The main advantages of both methods – a fast erection with a high structural resistance – can be only exploited if semi-precast concrete parts are used for the erection of towers. Therefore, such a construction method was developed and patented [3] at the Institute of Structural Engineering of the TU Wien

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