

# DEVELOPMENT OF ULTRA LIGHTWEIGHT HOIST ROPE OF TOWER CRANE FOR SUPER SKYSCRAPER

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**ABSTRACT:** Burj Khalifa, a skyscraper in Dubai, UAE, is the tallest man-made structure in the world. Its height reaches 828m but the taller super skyscrapers over 1 km have already been proposed. Tower crane is the key member for building such skyscrapers, which hoists heavy materials from the ground to the top of the construction site. The higher the building rises up, the longer hoist rope is needed and the weight of the rope gives burdens to the tower crane. The steel hoist rope, which was used for Burj Khalifa, weighs 6.32 kg/m and the total weight exceeds 5 tons when the crane climbs up to 800m. The crane has to lift not only the construction materials but also the hanging heavy rope. Therefore, the lighter and stronger hoist rope could provide a breakthrough in hoisting operation in super skyscrapers. A research on a novel hoist rope is on the way utilizing Dyneema, one of the UHMWPE (Ultra High Molecular Weight Polyethylene) fibers. They are the toughest fibers ever made and have usually been used in armor or mooring rope because of its lightweight, soft, and UV resistant property. Replacement of the steel rope with high strength fiber rope made of UHMWPE will reduce the weight of the hoist rope to about one-eighth, thus the load capacity of the tower crane could be drastically increased. This paper describes the design of the fiber hoist rope and the results of some performance tests.

**Keywords:** Super Skyscraper, Tower Crane, Load Capacity, Fiber Hoist rope, UHMWPE

## 1. INTRODUCTION

Successful construction of skyscraper can be made by proper and suitable combination of various construction technologies. A tower crane moving materials performs an essential role between them, because the period of construction can be reduced by the fast lift of many materials to the high place.

The highest skyscraper in the world, Burj Khalifa, has the height of 828 m. Even though the most of the programs were postponed or canceled due to the global financial debacle, new buildings higher than 1 km were planned for the past several years. It is still impossible to build these super skyscrapers with existing tower cranes used for Burj Khalifa, and new technologies are needed for the tower cranes building such super skyscrapers.

It cannot be a solution to increase simply the mechanical capacity of the crane because it would result in the heavier body of the crane and also the thicker structure of the



Fig. 1 World's tallest skyscraper Burj Khalifa









