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## Waste generated in high-rise buildings construction: A current situation in Thailand

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### Abstract

The construction industry is one of the key economic development activities in Thailand. An increasing of the construction sector also contributed to the increasing of environmental pollution. It was estimated about 13-30% of all solid waste deposition in landfills worldwide comprised construction and demolition waste. The international researches were showed that the construction industry generated high volume or quantities of material waste often attributed to the lack of on-site material control. Consequently, reducing construction waste was becoming a key environmental issue in the building construction industry. This paper aimed to provide an overview of waste generated in high-rise buildings construction and the situation of construction waste management in Thailand. By investigating the statistical information on construction waste and waste management of high-rise building projects, the analysis of environmental impacts was conducted to identify the most potential materials for minimizing construction waste.

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### 1. Introduction

Over the past ten years, Thailand has enjoyed exceptionally rapid economic growth, achieving a Gross Domestic Product (GDP) growth of up to 3-5 % annually (<http://www.tradingeconomics.com/thailand/gdp/forecast>) [1]. As seen in Fig. 1.

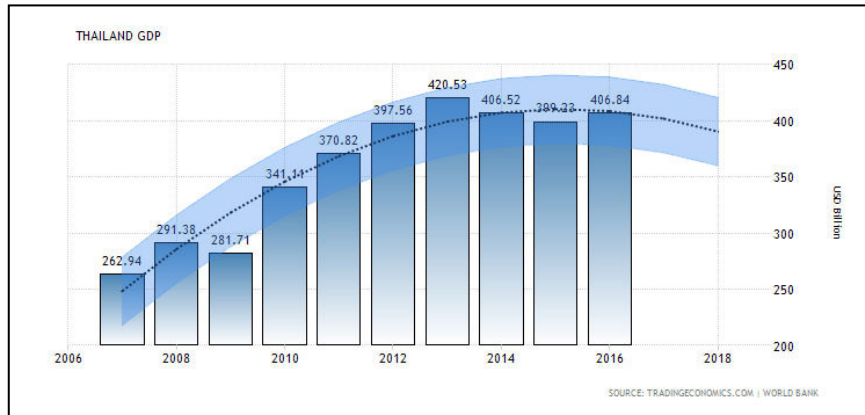


Fig. 1. Thailand's of Gross Domestic Product (GDP)

However, in parallel with this impressive economic development a severe degradation of Thai 's environment caused in part by the large amount of waste generated by construction activities associated with expanding urbanization and infrastructure program.

The term 'Construction and Demolition (C&D) waste' has been widely used for referring to the solid waste produced during new construction, renovation, and demolition of buildings and structures. [2] Construction and demolition waste account for a large share of all solid waste generated worldwide [3]. The reduction of the high rate of losses in construction sites, which includes waste materials and debris, is one of the main challenges faced by this sector [4]. C&D waste frequently accounts for 10-30% of the solid waste received at many landfill sites around the world.

Estimated that approximately 136 million tons of building-related C&D debris was generated in 1996. In UK, the wastage rates within the construction industry may be as high as 10-15. In Australia, C&D waste presents a significant proportion of the industrial solid waste going into landfills. [5] In Hong Kong, from 1993 to 2004, the annual generation of C&D waste had more than doubled, reaching an amount of about 20 million tons in 2004 a single year and more than 50% of waste deposited in a typical landfill come from construction [6]

The huge volume of C&D waste generated annually in various economies has long been an environmental problem around the globe. Thailand is currently experiencing an increasing amount of construction waste today without awareness of this.

## 2. Estimation of C&D Wastes Generation in high-rise buildings construction in Thailand

The past of building-related C&D waste generation in high-rise buildings construction in Bangkok in 2005 were estimated. Four categories of waste were examined, namely residential construction, nonresidential construction, residential demolition and non-residential demolition. The average generation rates of waste from residential construction and nonresidential construction were 56.23 kg/m<sup>2</sup> and 30.47 kg/m<sup>2</sup>, respectively. In the year 2005, 1,675,675 m<sup>2</sup> of residential building and 1,135,161 m<sup>2</sup> of nonresidential building were permitted for construction. Therefore, approximately 128,811.55 tons of building-related construction waste were generated in Bangkok in 2005.

The average generation rate of waste from residential demolition and nonresidential demolition were 984.66 kg/m<sup>2</sup> and 1,803.94 kg/m<sup>2</sup>, respectively. Since there is no record of permit for demolition, the average ratio of 10 % from new building permit record was used to estimate the areas of residential demolition and nonresidential demolition. Therefore, approximately 369,772.57 tons of building related demolition waste was generated in Bangkok in 2005. The total amount of waste from building-related construction and demolition (excluding renovation) in Bangkok in 2005 was approximately 498,584.12 tons per year or 0.20 kg per capita per day while the generation rate of municipal solid waste was 1.25 kg capita per day. Presently, the volume of construction area obtained from building permit data collected by the National Statistic Office in 2012. Result in average generation rates of waste from total building construction were 56.23 kg/m<sup>2</sup>, respectively. In the year 2012

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