

# Design of Segmental Precast Portal Frame for Red Line Mass Transit System in Bangkok

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## Abstract

This paper presents innovative design and development of massive precast segmental concrete portal frame system applied for Red Line Mass Transit project in Bangkok, Thailand. The Portals were originally designed as cast-in-place concrete for supporting typical 30 m span elevated viaduct. Several types of portal frame with single and continuous beams, single columns and T-head columns are considered. In order to cover all the structural members, cross beams with typical 3x3 m segmental box section, piers and pier heads are elaborately designed. Stressing and lifting procedures were analyzed to simplify the erection process. A U-tendon system was adopted to connect the precast pier segments to the pile caps. In addition, structural safety of segmental cross beams was verified by full-scale loading test.

**Keywords:** Mass Transit, Red Line, Portal Frame, Precast Concrete, Segmental, Post-tensioning

## 1 Introduction

Over the last decade, Thailand's infrastructure investment has drastically increased especially for a rapidly upgraded railway network. Ongoing Red Line Mass Transit System project, a commuter rail project to serve the greater Bangkok Metropolitan area, is one of the key developments. The route runs from Bang Sue Grand Station, which will be the new railway hub of Thailand and Southeast Asia's largest train station [1], to Rangsit terminal station. Total length is 26.3 km as the project alignment shown in *Figure 1*. 19.2 km is elevated, running on viaduct box girder. A length of 7.1 km, from Don Muang station to Rangsit station is on at-grade railroads.

For construction Contract 1, Bang Sue to Wat Samian Nari, The viaducts are supported by a system of more than 400 portal frames. *Figure 2* shows the outline of original portal frames, which were designed as cast-in-place concrete. On-site operations are time-consuming and thus using

cast-in-place would make construction nearly impossible to complete on time. Consequently, the original structures were redesigned and segmental precast concrete implemented.

By taking benefits of the segmental precast portal frame system, including acceleration of construction, quality control, durability and economy, sustainable structures can be achieved.



Figure 1. Red Line Mass Transit alignment