

COMPARISON METHOD OF SEGMENTAL BOX GIRDER (SBG) ERECTION
USING LAUNCHING GANTRY AND TRESTLE IN MRT PROJECT

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DEDICATION

I dedicate this dissertation to my loved husband, Saifull Bahri Bin Mohd Yusof, who has offered unwavering support and encouragement during the past two years of my master journey. He has cheered me on when I was discouraged, he has laughed at me when I was making a mountain out of some tiny molehill, wiped my tears away when the great research catastrophes struck, and he has most importantly been 100% confident in my ability to get this done. Thanks “Abang” for your support and counsel.

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ABSTRACT

Launching Techniques method will never become the most economical procedure for constructing all elevated structure or bridges. The launching process of the segmental box girder (SBG) is very complicated with sensitive and frequent changing structure loading performance. This research uses a comprehensive literature review to design and conduct a survey to investigate efficiency of span by span erection methods. Subsequently, obtain a consensus of expert opinion using the Delphi methodology to rank the most important in the construction projects. The suggestions, observations and information collected during the Delphi study and from the expert panel participants will assist in formulating strategies to improve the efficiency and effectiveness of erection method for elevated bridges construction. Data was collected and evaluated by statistical using Kendall's method to identify the most significant and consensus with the research objectives in order to improve project performance. The aim of this research was to analyse and compare the two construction methods, launching gantry (LG) and trestle (TSC) for erection or lifting precast segmental box girder (SBG). Furthermore, an economical comparison between the two construction methods was carried out based on the obtained results.

ABSTRAK

Kaedah Pelancaran Teknik tidak akan menjadi prosedur paling ekonomik untuk membina semua struktur atau jambatan yang tinggi. Proses pelancaran girder kotak segmen (SBG) sangat rumit dengan prestasi pemuatan struktur yang sensitif dan kerap berubah. Kajian ini menggunakan kajian literatur komprehensif untuk merancang dan menjalankan tinjauan bagi menyiasat kecekapan span dengan kaedah ereksi rentang. Seterusnya, mendapatkan konsensus pendapat pakar menggunakan metodologi Delphi untuk memberi peringkat yang paling penting dalam projek-projek pembinaan. Cadangan, pemerhatian dan maklumat yang dikumpulkan semasa kajian Delphi dan dari peserta panel pakar akan membantu dalam merangka strategi untuk meningkatkan kecekapan dan keberkesanan kaedah pemasangan untuk pembinaan jambatan yang tinggi. Data dikumpul dan dinilai dengan statistik menggunakan kaedah Kendall untuk mengenal pasti yang paling penting dan konsensus dengan objektif penyelidikan untuk meningkatkan prestasi projek. Tujuan penyelidikan ini adalah untuk menganalisis dan membandingkan kedua-dua kaedah pembinaan, melancarkan gantri (LG) dan trestle (TSC) untuk mendirikan atau mengangkat kotak segment girder pasang siap (SBG). Seterusnya, membuat perbandingan ekonomi antara kedua-dua kaedah pembinaan yang dijalankan berdasarkan keputusan yang diperolehi.

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LIST OF ABBREVIATIONS

MRT	-	Mass Rapid Transit
KAD	-	Key Access Date
KD	-	Key Date
LAD	-	Liquidated and Ascertained Damages
LG	-	Launching Gantry
NSC	-	Nominated Sub-Contractor
SBG	-	Segmental Box Girder
SSME	-	Span by Span Method of Erection
SSP	-	Sungai Buloh-Serdang-Putrajaya
TSC	-	Trestle System Crane
WPC	-	Work Package Contractor

LIST OF SYMBOLS

W	-	Kendall's coefficient
R	-	Mean

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CHAPTER 1

INTRODUCTION

1.1 Background

The first viaduct span construction at Kepong Baru Station was successfully completed by Mass Rapid Transit (MRT) Sungai Buloh-Serdang-Putrajaya (SSP). Span erection technique using launching gantry (LG) method and crane erect trestle system (TSC) method to accommodate 13 numbers of segmental box girder (SBG) in each span of the viaduct. The steel cables are threaded into ducts that are cast inside the segments once the SBG's are in place. The pre-cast segments cables were subsequently stressed to form a continuous and regular viaduct stretch. Almost 95 percent of projects in the MRT SSP Line use the launching gantry (LG) system to construct segmental viaduct. TSC system was used by the other elevated tracks, typically for sections spanning roads, busy highways and large rivers. The track-laying work on these viaducts will then take place creating the MRT SSP Line's 38.7 km elevated segment when most of the viaducts are completed.

The various consequences of the erection process that is being used have prompted the construction of the superstructure for the segmental bridge is a complicated process. Such methods of erection rely on and relate to the foundations of bridge construction, substructure and superstructure, structural resistance, state of load, behavior of materials and environmental influences. In order to develop sequences of the work function in construction planning, it must be understood that the structural analysis in construction engineering requires the necessity of each erection method such as specific equipment, machinery and all the work tasks required for the site installation that directly impacts the project.

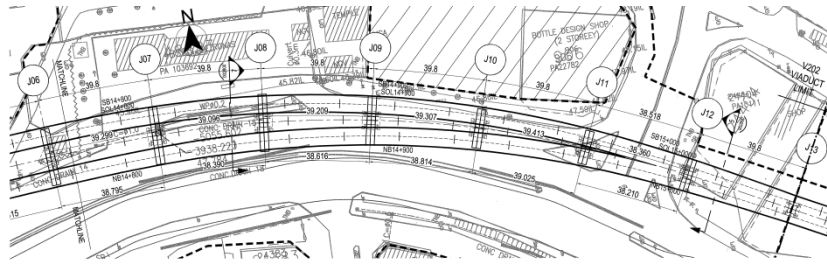


Figure 1.1 Area of Research Study

1.2 Problem statement

One of the key factors influencing the expense, profitability, and performance of construction projects is the construction system (Thomas et al., 1990). The selection of the suitable SBG erection system is therefore essential to the project's success. Selecting the method to launch the Segmental Box Girder is a complex problem of decision-making. During the planning phase of assembly and dismantling of Launching Gantry and Trestle, SBG erection, prefabricated segmental box girder (SBG) delivery time, planners have to make some decisions concerning:

- (1) Construction method;
- (2) Casting yard position and settings;
- (3) Precast concrete elements transport;
- (4) Number of resources; and
- (5) Productivity.

Every set of these decisions is called a project scenario. Throughout the study, the terms scenario of construction and candidate solutions are used interchangeably. Each of these decisions has a significant impact on the conflicting goals of construction projects, which minimize the overall length of the project and reduce the total cost of the project. However, it is not a straightforward process to determine the effect of each construction scenario on achieving the project goals. Projects can take longer and cost more than expected when choosing the best

construction scenario. Therefore, to assist planners in carrying out this complicated planning mission, a new decision-making model is required.

In the MRT project, "Work Package Contractor (WPC)" it is necessary to complete the construction of the segmental box girder (SBG) according to the "Key Date (KD)" as scheduled and to move it to PDP without delay. This is a "Key Access Date (KAD)" it is essential for the other "Nominated Sub-Contractor (NSC)" to continue the work on the railway track. If WPC do not complete the work as scheduled, PDP will be charged for the liquidated and ascertained damages (LADs or LDs). Due to the massive time and budget constraints, WPC needs to determine the technique is efficient to complete the works with the easier and faster to erect the segmental box girder. There are two approaches in this project that will use either launch gantry (LG) or trestle (TSC) methods or both.

1.3 Research Objectives

Research's overall objective is to examine the current status, problems and approaches in the construction of elevated bridges. Through researching the potential for segmental box girder erection precast is using launching gantry and trestle methods. The research's main objectives are:

- 1) To understand the feasibility of the Launching Gantry and Trestle methods ' erection process.
- 2) Comparison of the analysis using Launching Gantry and Trestle methods.
- 3) Impact of the Launching Gantry and Trestle methods to the bridge's construction project.

1.4 Research Questions

In particular, the study would attempt to address the following research questions:

1. What is the main problem or obstacle and problems with erection segmental box girder methods during MRT construction?
2. How can the problem be solved and what is the alternative?

1.5 Significance of Study

This research study is important in determining the correct prefabricated segmental box girder erection method for elevated bridge construction, particularly in the congested and restricted area including urban, highway, existing utilities and other factors. This research therefore needs to investigate and examine all the factors to support planners and project team in carrying out this complex planning activity and have good detailed progress reports to resolve future claims and project. Project will take longer and cost more than required if without identifying the optimal construction scenario. Therefore, successful project management to ensures prompt, budget-based and project specification is required.

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