



“**SEGMENTAL BOX PUSHING TECHNIQUE:**

**RELATED PROBLEMS AND SOLUTION**”

**(MAJOR - I)**

A dissertation submitted in partial fulfillment of the

requirement for award of the degree of

MASTER OF TECHNOLOGY

In

CIVIL ENGINEERING

With specialization in

STRUCTURAL ENGINEERING

BY

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**CERTIFICATE**

This is to certify that the project entitled “SEGMENTAL BOX PUSHING TECHNIQUE: RELATED PROBLEMS AND SOLUTION” being submitted by me is a bonafied record of my own work carried out by me under the guidance and supervision of Dr. Narinder Dev, Professor in partial fulfillment of requirement for the award of the degree of Master of Engineering (Civil Engineering), with specialization in Structural Engineering, from Delhi Technological University, Delhi.

The matter embodied in this project has not been submitted for the award of any other degree.

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**ABBREVIATIONS**

|  |  |
| --- | --- |
| ADS | Anti-drag Sheet |
| ANSB | Anand Vihar |
| DLI | Delhi |
| GA | General arrangement |
| FHWA | Federal Highway Administration |
| GI | Galvanized iron |
| GZB | Ghaziabad |
| HYSD | High yielding steel deformed |
| I.J.S | Intermediate jacking station |
| IRC | Indian Road Congress |
| IRS | Indian Railway Specifications |
| MS | Mild steel |
| RUB | Road under Bridge |
| ROB | Road over Bridge |
| RCC | Reinforced cement concrete |
| UK | United Kingdom |
| US | United States |
| m | Meter |
| mm | Millimeter |
| Cm | Centimeter |

**SYMBOLS**

|  |  |
| --- | --- |
| Ø | Angle of internal friction of soil |
| ᵧd | Dry density of soil |
| c | Cohesion of soil |
| Sn | Stability number |
| F | Factor of safety |
| δn | Effective normal stress on the failure plane of soil |
| Ød | Developed angle og internal friction of soil |
| cd | Developed Cohesion of soil |
| i | Stable soil slope angle |
| v | Angle of cutting edge with vertical |
| ᵧ | Bulk density |
| qu | Ultimate bond strength |
| µ | Normalized bond strength |
| CIL | Correction factor for drill hole diameter (Nail Length) |
| CIF | Correction factor for drill hole diameter (Force) |
| DDH | Drill hole diameter |
| fy | Yield strength of concrete |
| Fst | Factor of safety for nail bar strength |
| Fp | Factor of safety for pullout resistence |
| SH | Horizontal Spacing |
| Sv | Vertical Spacing |

**ABSTRACT**

This herein project, aims at presenting the solution for tunnel face stability in Box Pushing projects. Present day Intensity of Traffic, both Rail & Road, due to the fast development of Industries and other Infrastructures, is very heavy and so it cannot be disturbed, for construction of RUB or Canal Crossings, drainage conduit etc by conventional method i.e. open cut system. In order to avoid the inconvenience and disruption of traffic associated with traditional cut and cover method, Box Pushing (also called Jacket Box Tunnel) technique is developed, to construct RUB, where in R.C.C. boxes are cast in segments outside and pushed through the heavy embankments of rail or road by heavy jacking. The required thrust to push the segments is generated through thrust bed. Line and levels of pre-cast boxes during pushing are controlled by thrust bed.

Construction of RUB by segmental box pushing is a non intrusive technique for construction of under bridges beneath existing surface infrastructure such as railways or highways. This method is being used by Indian Railways for constructing RUB for last few decades but it has gained importance recently due to heavy infrastructure growth leading to a number of road infrastructure projects. At present, the work is being done in diverse conditions and during execution of work in the field; various problems are being faced by the site engineers.

This project aims at presenting the Box Pushing technique, comprehensively, in addition to the discussion on problems being encountered during execution and their probable causes. Efforts have also been made to propose solution for the most critical practical problem of tunnel face stability by performing Field Model Study to predict the behavior of the suggested solution in a specific structure under working conditions. The concept of soil nailing is proposed to be used for the stability of tunnel face during box pushing operations. The fundamental concept of soil nailing consists of reinforcing the ground by closely spaced passive inclusion to create insitu coherent gravity structure, and thereby increase the overall shear strength of the insitu soil and restrain its displacement on loading. A small scale model (proportionate to the dimensions of box size) is chosen for experimental study of evaluation of soil nailing technique.

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