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THE STUDY OF PROBLEMS INVOLVED DURING EXECUTION OF RAILWAY UNDER BRIDGE USING BOX PUSHING TECHNIQUE AND ITS REMEDIES

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ABSTRACT

The topic entitled about issues involved during exaction of Railway under bridge using box pushing technique and its remedies, illustrate about the method of execution of railway under bridge and issues involved during execution by box pushing technique for widening of existing roads and its remedies. It also explains about the methodology involved in application of box pushing technique for construction of RUB (Railway under bridge). This topic primarily gives attention towards problems that arises during execution and its resolution.

KEYWORDS: Box Pushing Technique, RUB, Thurst Bed, IRC, IRS, IS Codes Etc

INTRODUCTION

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 the disturbed, for construction of under bridges or Canal Crossings, drainage etc by conventional i.e. open cut system. So to construct such structures, Box Pushing Technique is developed where in R.C.C. Boxes in segments are cast outside and pushed through the heavy embankments of Rail or Road by jacking. The required thrust is generated through thrust bed, as well as line & level of precast boxes is also controlled. Nowadays whenever there is necessesity to make underpass for RUB;s(Railway under bridge) for widening of existing road or canal crossing Box pushing technique is being used. The Box pushing technique favored over conventional methods which allows railway traffic without interruption during execution of RUB.

The development of infrastructure is key to developing of any nation most importantly country like India most of interstate transportation is done by Railways. Bridges are main link in any transportation system either road ways or railways. There are one lakh bridges in India, most of them are over 100 years old or 150 years old. Some of bridges have outlived their service life. Generally bridges are inspected by Railways officials who fall in their boundary. The construction of RUB's and ROB's, which are required at crossing of Highway, are to be handled by concerned road authorities in concurrence of Railways. The construction of RUB's and ROB's is done by concerned road authorities under the supervision of Railways.

BACKGROUND

This RUB is situated at PADIL junction, Mangalore under jurisdiction of Palakkad division, southern railway. This work is taken up by NHAI for southern railway. This road is exiting over NH-48 at Padil, Mangalore.

Agency: Raj deep Buildcon Pvt Ltd, Ahmednagar.

BOX PUSHING WOK: M/s RAK projects Ltd Nagpur

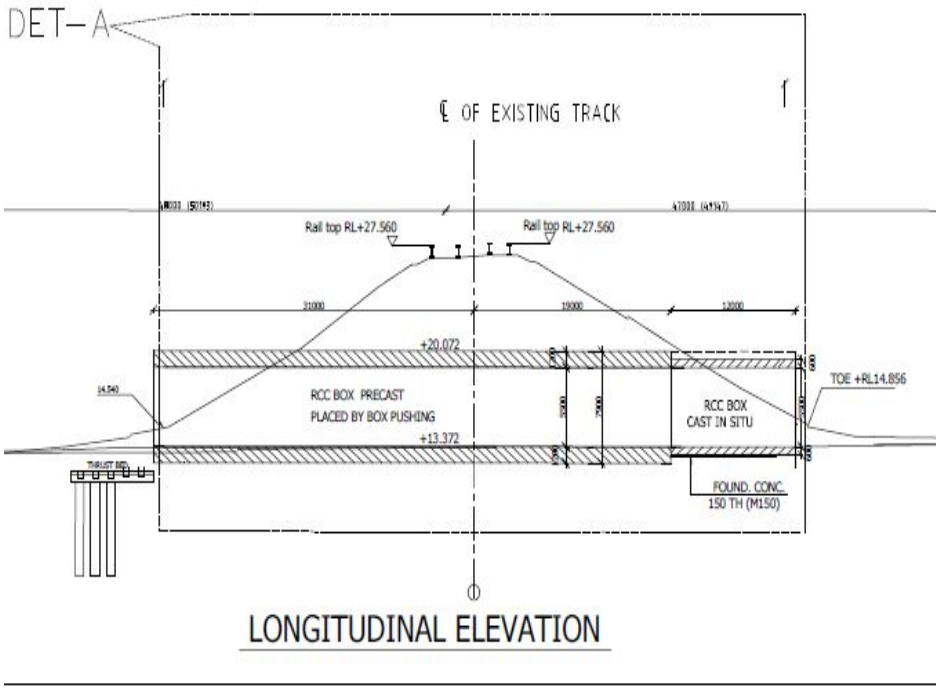

Figure 1

SCOPE OF WORK

10Nos of Boxes each 5Mts length (12.5x5.6Mts inner dimension) the total length of box pushing 50Mts

12mts box cast in situ for two lanes.

SALIENT FEATUES

- This RUB consists of One vent of 12.5x5.6 Mts inside size and wall thickness 1.2Mts(outer size 14.9x8Mts)
- The box is crossing 2 existing lanes and one future lane for the height of 15mts.
- Each box weighs 767 tons and using of 65 tons of steel (epoxy coated steel) and 307 cum of concrete.
- Length of the vent is 62 mts long. (50 mts long by box pushing and 12 mts long cast in situ)
- RCC box with M40 grade.
- Trust bed of size 8x15.5 mts 0.9mts thickness with M30 grade concrete provided with 20 pin pockets for pushing. Pocket size 500x500x500mm.
- Front cutting edge shield with 25mm thickness MS plate and 2mts projection.
- Rear shield plate with 12mm thick plate all round.
- Drag sheet are provided in 2 layers with 0.6mm thick.
- Pushing of segments is done with Hydraulic jacks of 300 tons.

- Epoxy coating is done on all-round of ourter surface which is in contact with earth.
- The design of major components of system such as thrust bed and auxiliary bed and RUB box Segments will be done as per IRC, IRS and IS codes to satisfy as per specifications particularly Railways.
- The design and drawings of all the components of structure including trust bed and auxiliary bed to be approved by Railways before preceding the construction.

METHODOLOGY FOR CONSTRUCTION

- First the casting of thrust bed is done in line with box pushing.
- The casting of casting bed is done just behind the thrust bed in line with box pushing
- The casting of auxiliary beds of 6 nos is done adjacent to thrust bed and casting bed.
- The casting of 10 Nos of box segment of 5Mts length is done on thrust bed and casting bed and auxiliary beds.

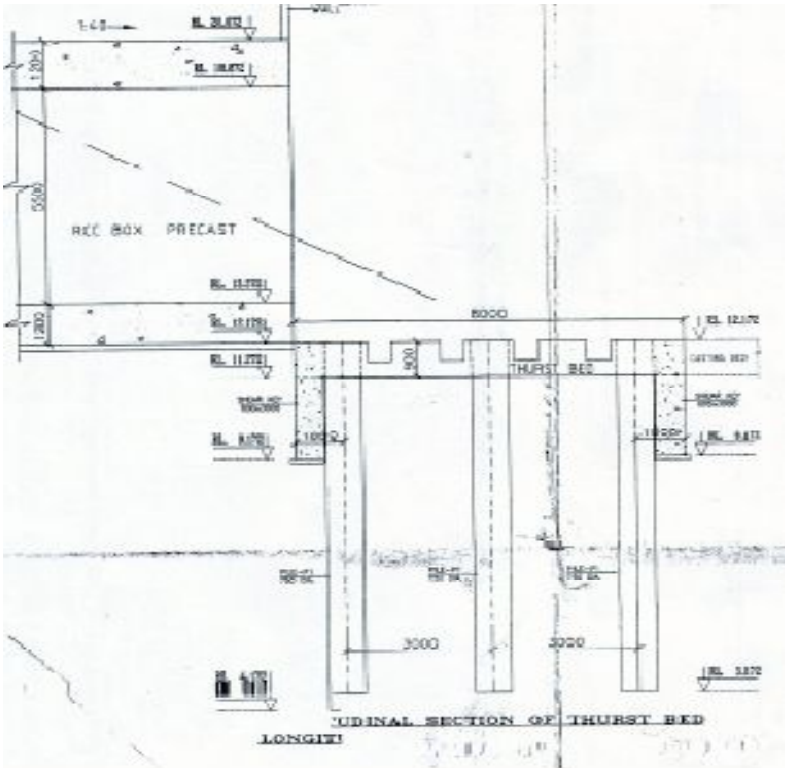

Figure 2: Thrust Bed

BOX PUSHING OPERATION

- The box pushing operation is carried out from reaction obtained from thrust bed. The screed which existed on thrust bed is dismantled at pin pocket location, pin pocket are cleaned, pins are inserted and Hydrualic jacks-10/12 nos are installed between pins and bottom slab of the first box with packing plates and spacers.
- A 20mm thick plate is provided, butting against bottom slab of box, in front of the jacks to avoid damage to concrete surface.

- Soil neiling with insertion of 25mm Hysd steel rod of length of 12Mts is done at the spacing of 500mm to avoid falling of earth during box pushing operation.
- After each push of maximum of 250mm jack is released, jacks again packed with packing plates and spacers.
- The second box segment is brought in position behind the first box.
- 10Nos Hydraulic jacks of 300 tons each capacity, are housed between two segments in addition to 4 Nos of 300 tons jacks already provided between thrust bed and 2nd box segment.
- 4Nos of jacks of capacity of 300tons are provided in 2 slots made in each side walls to facilitate correction of line and level of box during box pushing.
- Earth work which fallen in front of the first box segment is carted away during pushing and protruding nails are driven further to strengthen embankment.
- After pushing of first box of 600mm, the box pushing of succeeding box (rear box) will be done and after pushing of second box of 600mm, the box pushing of third box will be done. The box pushing operation is repeated for all the boxes.
- The box segments which are cast away from the line of pushing brought to the position of line of box pushing.
- The process is repeated till the front box is pushed to required position.
- The recess between boxes is filled with concrete.
- Cutting edge is dismantled and front face of first box segment is cast in plumb.

Figure 3: Box Pushing Operation under Progress

PROBLEMS DURING BOX PUSHING OPERATION AND ITS REMEDIAL MEASURES

Shifting of Longititudinal Alignment

Effects

- Pressure on jacks of one side will increase abruptly, may cause failure of jack.
- There will be gap creation at the junction of two boxes.

- Road becomes skew, may lead to damages through hitting of box by vehicles

Remedial Measures Taken during Box Pushing

- Reference pegs to be fixed with respect to the centre of box.
- Regular checking the longititudinal alignment.
- Differential jacking to rectify longititudinal alignment.

Occurrence of Collapsible Strata

Effects

- Sudden collapse of sub grade.
- Settlement of the track.
- Safety hazards during the passage of traffic.
- Cautious and slow process.

Remedial Measures Taken during Box Pushing

- Stabilization of sub grade is done with betonies.
- Frequent recoupment of ballast and track attention is carried out.
- Installation of CC cribs and girders is done to support track.
- Gunny bags filled with sand is used to support embankment.
- Small length attempted during box pushing.

Tilting of Box

Effects

- Lifting of track adversely.
- Differential earth cushion above the box.
- Creating gap between two box segments.
- Excessive resistance in pushing of subsequent segments.

Remedial Measures Taken during Box Pushing

- Proper fixing of metal sheet at rear end of segments
- Obstruction against cutting edge removed during box pushing
- Pushing is done in small lengths
- Differential jacking is done to rectify tilt

Occurrence of Hard Rock

Effects

- Lifting of box/deviation in alignment.
- Manual excavation becomes ineffective.
- Failure of jacks due to excessive pressure.
- A slow process affects entire progress.

Remedial Measures Taken during Box Pushing

- Mechanical arrangements such as compressor, pavement breaker, splitters are used to break the rock
- Controlled blasting is done to remove the rock.

Disturbance of Track Geometry

Effects

- Abrupt level variation resulting in deficiency of ballast requires frequent recoupment.
- Bulging of side slopes.
- Shifting of earth mass along the box.
- Lateral shifting of alignment.

Remedial Measures Taken during Box Pushing

- Unloading of sufficient ballast well in advance.
- Deployment of sufficient labor to correct disturbed track structure.
- Daily pushing without interruption to avoid frictional resistance.
- Counter weight on the exit end of the Bank.

CONCLUSIONS

- Box pushing technique requires skilled labor and staff to avoid problems of occurrence as above.
- The cost of construction is less if it is executed in proper manner.
- Proper panning and precautionary measures are very much required during Box pushing.
- Circumstances are unpredictable during box pushing which may cause cost overrun.

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