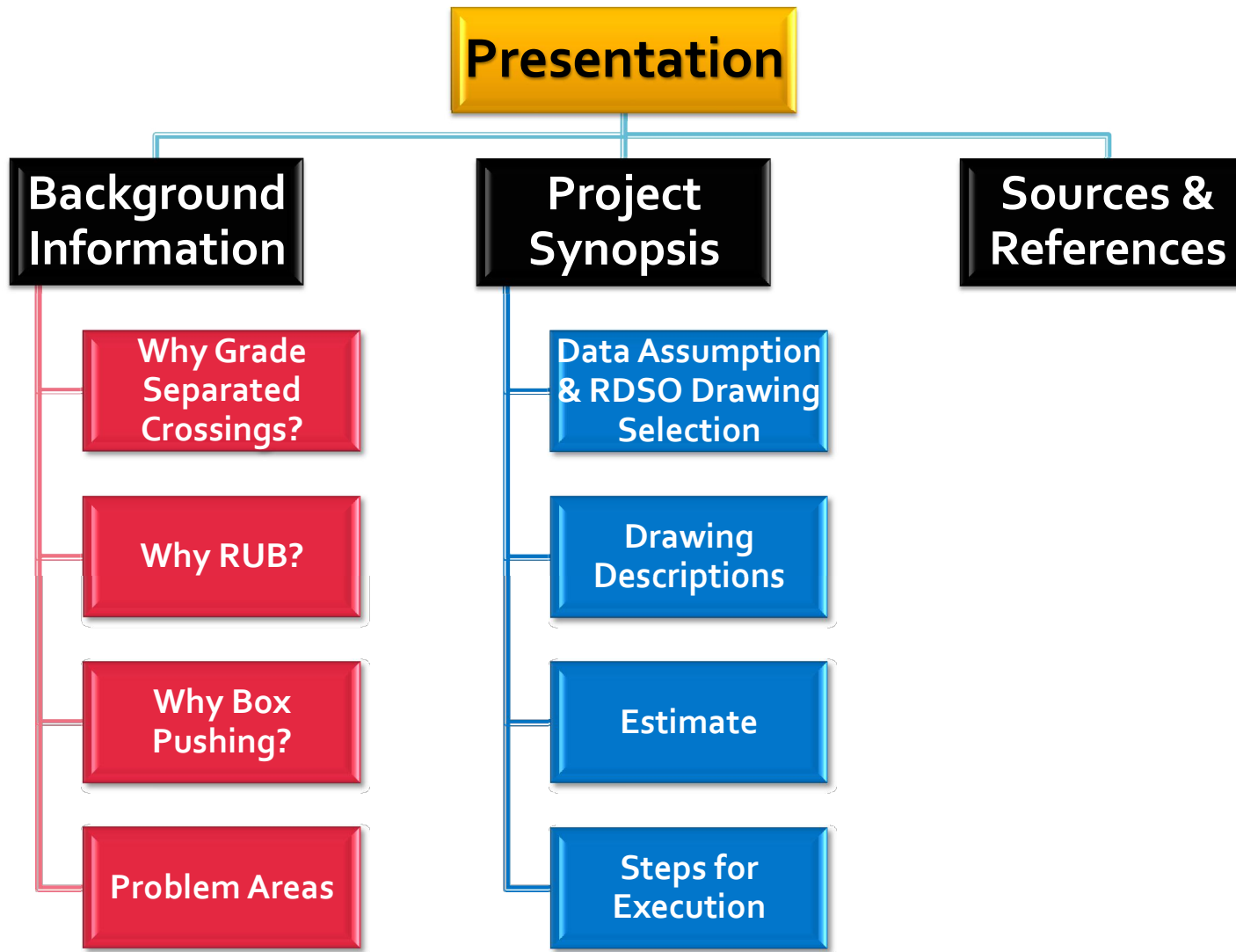


PRESENTATION ON

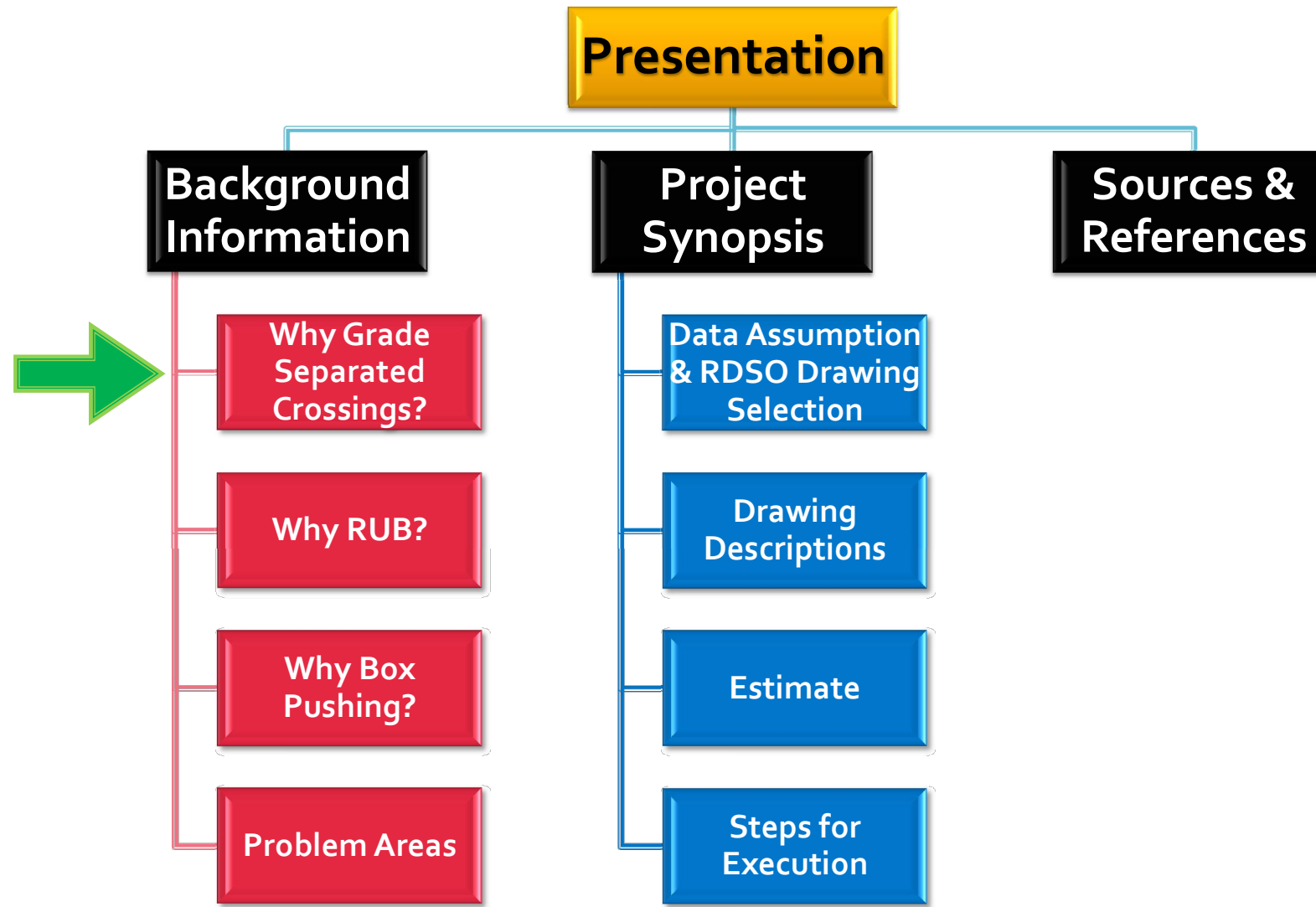
**“CONSTRUCTION OF NORMAL HEIGHT SUBWAY  
(5M X 5M INSIDE) ON 5M BANK HEIGHT ON SINGLE  
LINE CONSIDERING THE FUTURE PROVISION OF  
DOUBLE LINE USING BOX PUSHING METHOD WITH  
BARREL LENGTH 26M (ASSUMING RELEVANT  
DATA).”**

**BY,  
ATASI ROY MALAKAR (55 01 027)**

# PRESENTATION BLUEPRINT

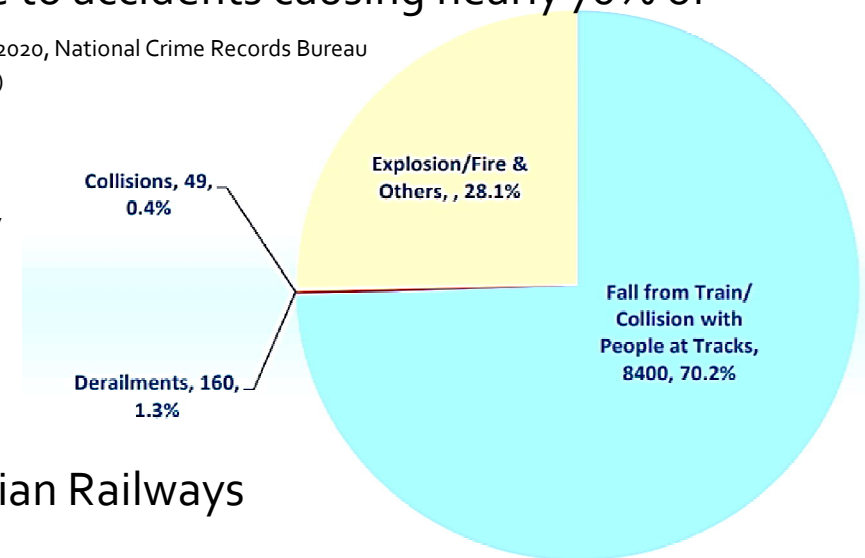


# PRESENTATION BLUEPRINT



# BACKGROUND INFORMATION

- Indian railways is one of the largest Railway systems of the world which spreads across 64,000 route kilometres and is fully operated and owned by Government of India
- The Road Traffic crosses the Railway Track either on “Grade Separated Crossings” (Road and Rail at different levels) or at “Level Crossings” (Road and Rail at same levels)
- The level crossings are made to facilitate smooth running of traffic in a regulated manner but as it is evident from the adjacent pie chart, it is very vulnerable to accidents causing nearly 70% of fatalities over Indian Railways in 2020 (Accidental Deaths & Suicides in India 2020, National Crime Records Bureau Ministry of Home Affairs & Indian Railways Vision 2020, Government of India Ministry of Railways, December 2009)
- Between 2012 and 2018, around 475 people died in accidents at unmanned level crossings across the country
- As per Railway Board’s letter no. 2008/CE-I/LX/Target 2010-11(Pt-I), dated 14.03.2011, Five Year Master Action Plan for elimination of unmanned L/C was adopted by Indian Railways

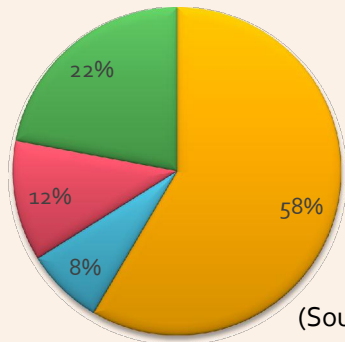


- Crossings (At-Grade/Level + Grade Separated)
  - Level Crossings= (Better **Accident Rate Per Million Train Kilometre** + better **Line capacity** + better **Operation & Maintenance Costs incurred on gates**)

# WHY GRADE SEPARATED CROSSINGS?

- Elimination of Level Crossings done by: a) Road Under/Over Bridge, b) Merger/Diversion, c) Closure, d) Manning

ELIMINATION METHOD	PREREQUISITE	BRIEF DESCRIPTION
<b>1. Construction of Grade Separated Crossings</b>	TVU of 1 Lakh	<ul style="list-style-type: none"> <li>• <b>Permanent</b> Elimination of L/C</li> <li>• Costs <b>INR 3-10 Cr</b>, takes 6-12 months</li> <li>• Usually a one-time investment shared between Railways and State government</li> </ul>
2. Merger or Diversion	A nearby Manned L/C or ROB/RUB	Diversion Road constructed on Railway Land
3. Closure of Level Crossing	Low TVU + No road on either side + CRS sanction + NOC from Collector of State Govt.	Level Crossing closed
<b>4. Manning (only for Unmanned LCs)</b>	TVU of 3000 or more	<ul style="list-style-type: none"> <li>• Installing barriers or gates, a hut with a telephone line connected to the nearest station master=costs around <b>INR 10-12 lakh per gate</b></li> <li>• Plus the <b>monthly salary</b> of the gatemen (At least two men to operate the gate)</li> <li>• Interlocked Gates cost more</li> <li>• Station master has to telephone gateman to close the gate; gateman closes the gate and confirms back; only then is the train allowed to cross; <b>Any mistake can cause accident</b></li> <li>• <b>Temporary Solution Stage in the long term</b></li> </ul>



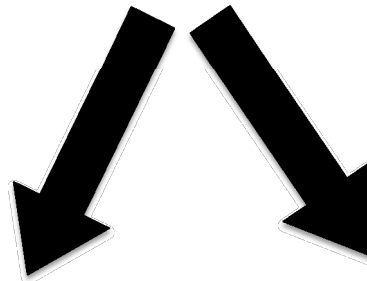
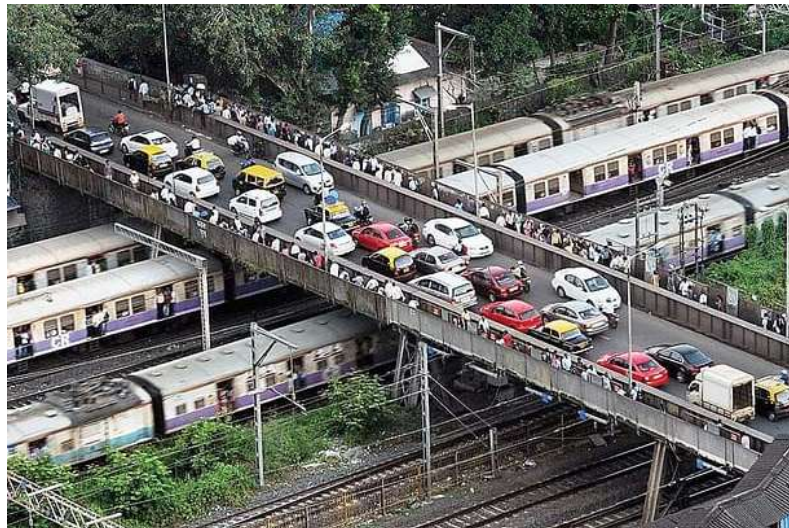
(Source: The Telegraph, 14.12.2018)



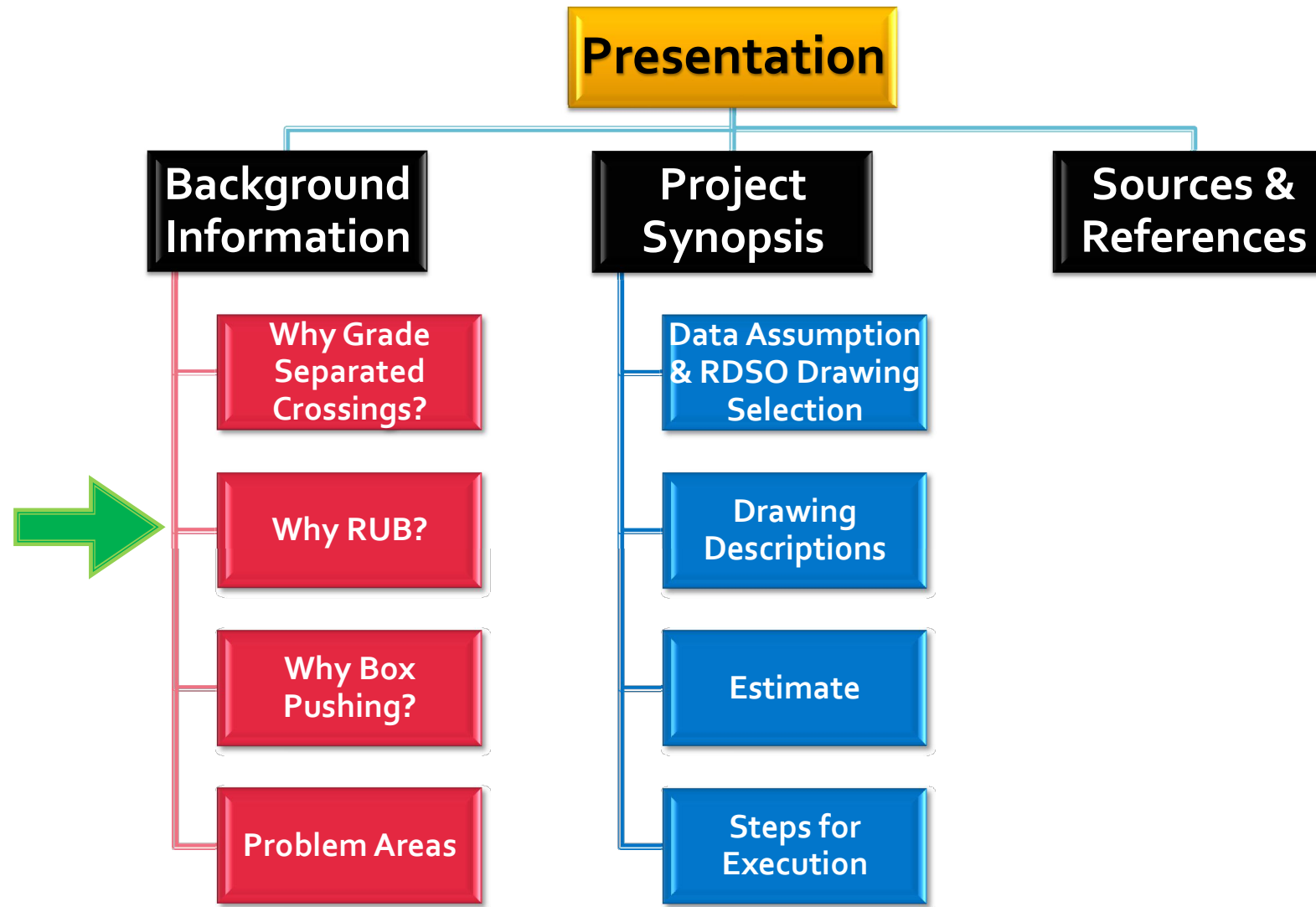
# IMPORTANT SIDE NOTES

- Which level crossings should be manned and which eliminated permanently by building bridges or underpasses or limited-height subways are determined by road and train traffic on the route
  - It is measured by an international metric called Train Vehicle Unit (TVU).
  - TVU is derived by multiplying the total number of trains in a day with the total number of road vehicles at the crossing, through a week-long census physically carried out by three railway officials. This exercise is done every three years and every railway crossing is assigned a “TVU per day” value
- On January 31, 2019, Union Minister Piyush Goyal announced that the Railways had achieved its target of eliminating all unmanned level crossings on broad gauge lines
- Now that all the unmanned level crossings across the 64,000 km of broad gauge network are gone, the next frontier is the 21,901 manned level crossings.
- Even a manned level crossing is an irritant to mobility. A lapse on anyone’s part can cause an accident. So after unmanned, the next front for the Indian Railways is its busiest manned level crossings
- Talks are on regarding how to replace the 2,700-odd heavy-traffic level crossings with road bridges or other means . One step being considered is interlocking the 1,250 manned level crossings whose TVU is 20,000 and more on a priority basis
- Source- “All lines clear: Ground reality of unmanned railway crossings”, Indian Express Avishek G Dastidar, Feb 17, 2019

# LONG TERM GOAL: AT- GRADE TO GRADE SEPARATED CROSSINGS



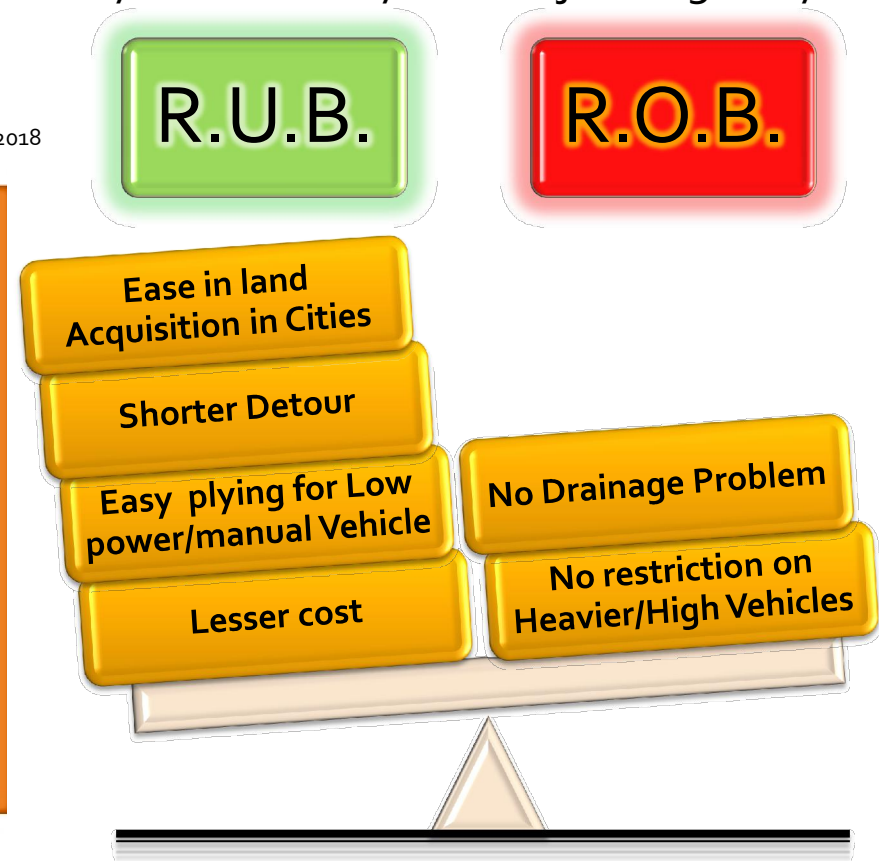
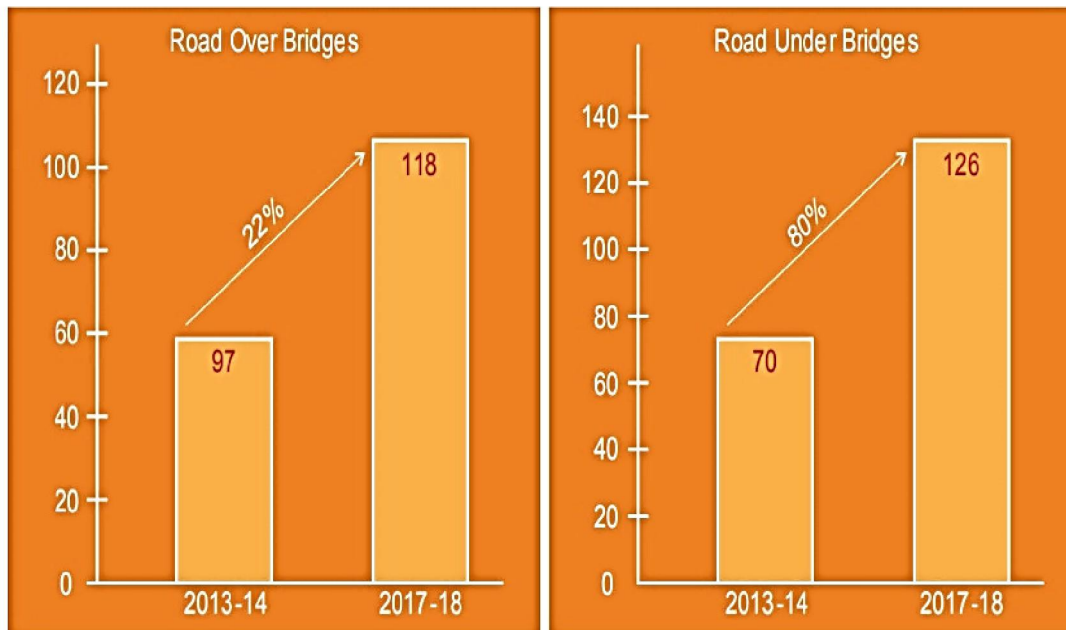
# PRESENTATION BLUEPRINT



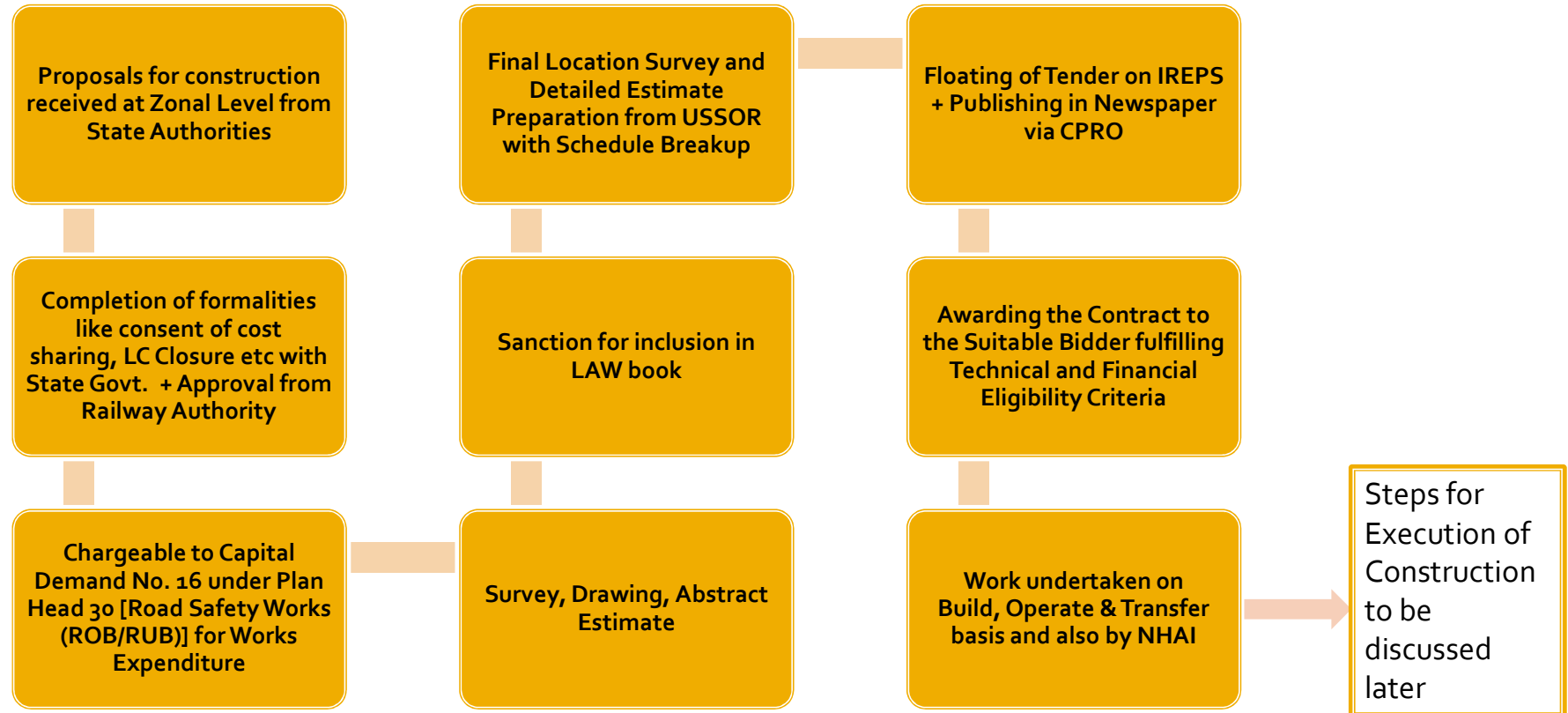
# WHY ROAD UNDER BRIDGE?

- Grade separated Structures are structures through which traffic flows at different levels. As per, Indian Road Congress 6-Lane manual 2013 (SP 87) they are: Vehicular Underpass, Vehicular overpass, Pedestrian Underpass, Cattle Underpass, Light Vehicular Underpass, Foot Over Bridge, Cloverleaf, Trumpet Interchange, **Road Over Bridge** and **Road Under Bridge**
- A structure provided over the railway lines to carry Project highway is called Road Over Bridge (ROB) whereas the structure provided below the railway lines to carry the Project Highway is called Road Under Bridge (RUB)

Source: Years Achievement Booklet "Vibrant Railways Strengthening Bengal" by Indian Railways for 2014-2018



# IMPORTANT SIDE NOTES

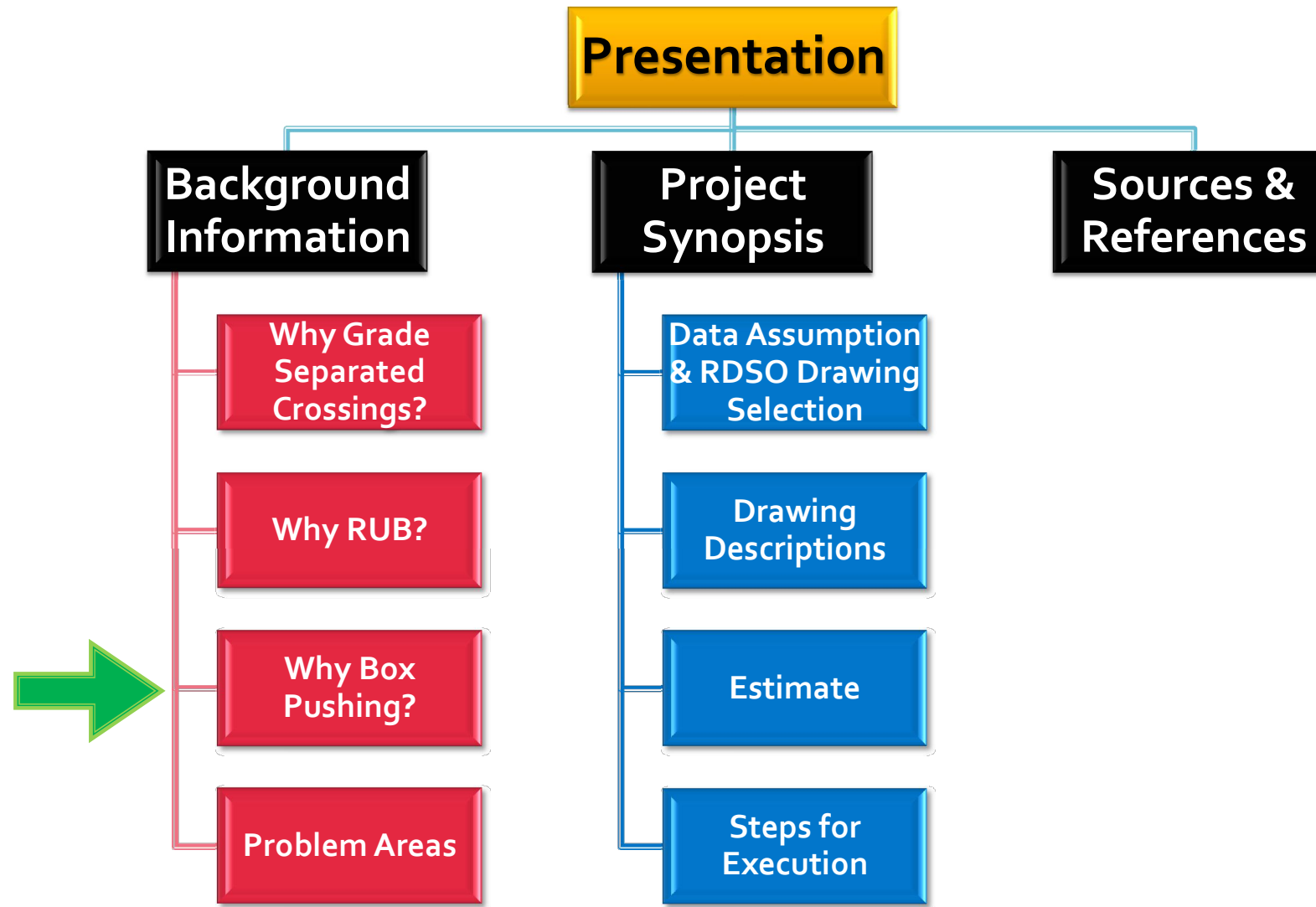


# IMPORTANT SIDE NOTES



- RUB is feasible only where Railway track is on high embankment ( $>4\text{m}$ ) and also where it is not a water stagnant area
- RUBs/Subways (RDSO/B-10155) can be : i) Normal height subways (vertical clearance  $>5.0\text{m}$ ), ii) Limited height subways (vertical clearance  $\leq 5\text{m}$  and  $\geq 3.6\text{m}$ ) and iii) Restricted height subways (vertical clearance  $\leq 3.6\text{m}$  and  $\geq 2.5\text{m}$ )
- Designing RUB is beyond the scope of this project but the Steps in brief are:
  - Load calculation per RCC box segment: Total Dead weight, Total Earth Pressure and corresponding Jacking Force Required • Assuming Thrust Bed dimensions and calculating Corresponding Weight and Passive Resistance from the Keys (Should be  $>$  Jacking Force required to push the Box Segments by a factor more than 1.25) • Design of Thrust Bed for the given dimensions and Loading system • Design of Thrust Wall, Front Key, Rear Key, Middle Key(s) • Design of Auxiliary Thrust Bed, its Thrust wall and keys for Auxiliary Thrust Beam • Design of Cutting Edge

# PRESENTATION BLUEPRINT



# WHY BOX PUSHING?

- RUBs are constructed by: a) Launching of RCC boxes by Cut & Cover Method, b) Launching/ Air Pushing of Boxes by using RH Girder, and c) Box Pushing Method through Embankment



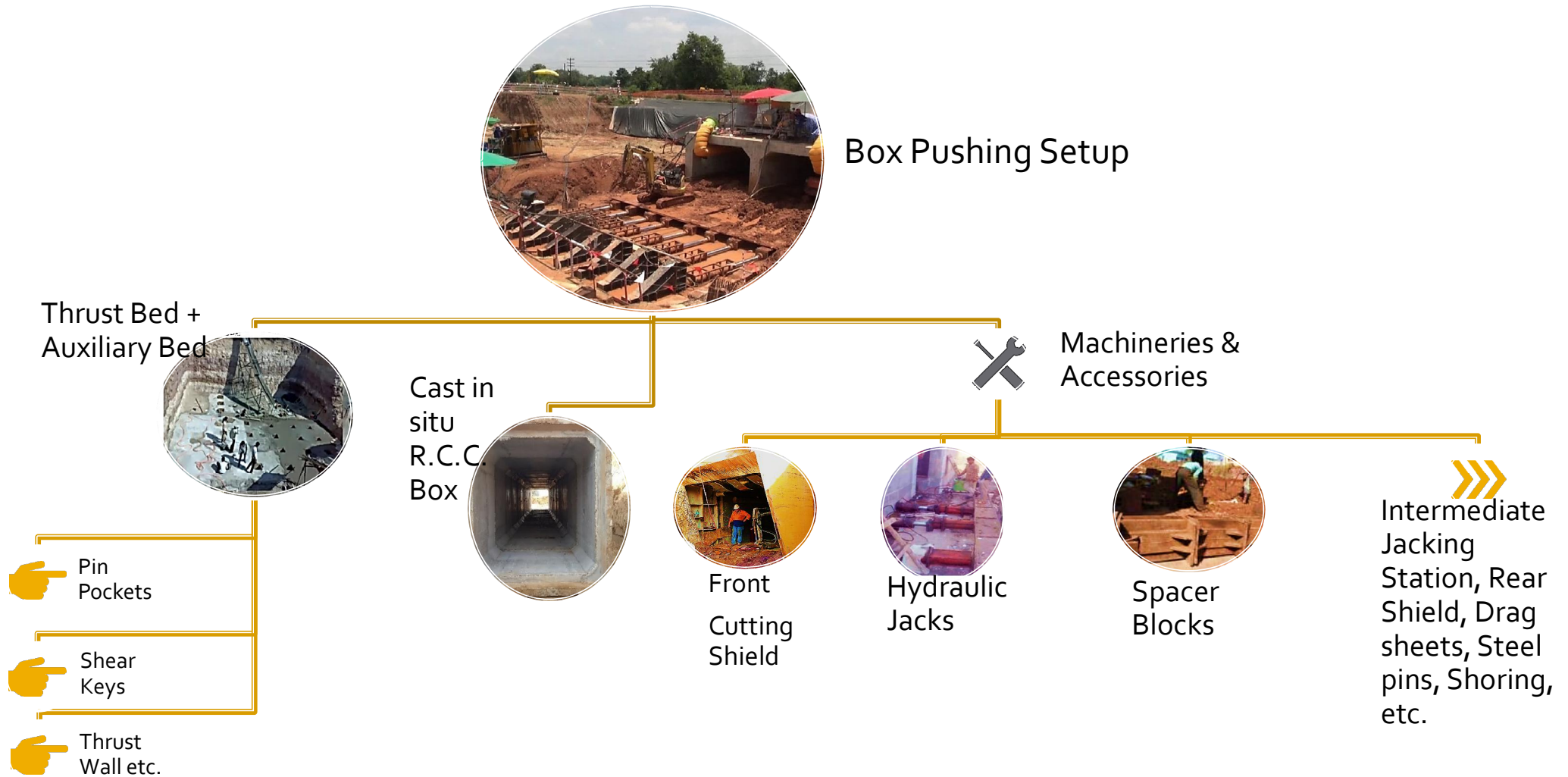
# WHY BOX PUSHING?

- RUBs are constructed by: a) Launching of RCC boxes by Cut & Cover Method, b) Launching/ Air Pushing of Boxes by using RH Girder, and c) Box Pushing Method through Embankment

Method of RUB Construction	Advantage	Disadvantage
Cut & Cover Method	<ul style="list-style-type: none"> <li>Economical</li> </ul>	<ul style="list-style-type: none"> <li>Larger Block Duration</li> <li>More Engagement of Officers/Staffs</li> <li>Heavy Machinery Required</li> <li>Machinery failure may cause major traffic disruption</li> </ul>
RH Girder Method	<ul style="list-style-type: none"> <li>Less Traffic Disruption</li> <li>Smaller Block Duration</li> </ul>	<ul style="list-style-type: none"> <li>More Engagement of Officers/Staffs</li> <li>Heavy Machinery Required</li> <li>High RH girder dependency</li> <li>Cumbersome</li> <li>4 blocks /RUB</li> </ul>
Box Pushing Method	<ul style="list-style-type: none"> <li>No Traffic Disruption</li> <li>Better quality control</li> <li>Accident by trench collapse nil</li> <li>Saving in Manpower &amp; Machinery</li> <li>No heavy equipment/crane</li> <li>Seamless joints</li> <li>Less involvement of other depts.</li> </ul>	<ul style="list-style-type: none"> <li>Costly</li> <li>Needs trained staff and skilled supervision</li> <li>Imposition of Caution order for longer duration</li> <li>Chances of sudden collapse at the face of Cutting edge leading to unsafe situation</li> </ul>

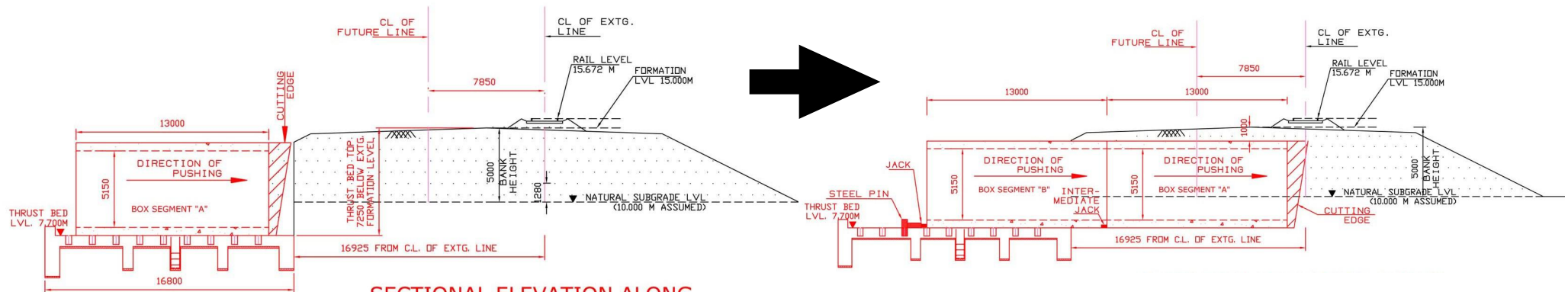
# IMPORTANT SIDE NOTES

## ■ Components of Box Pushing Method:

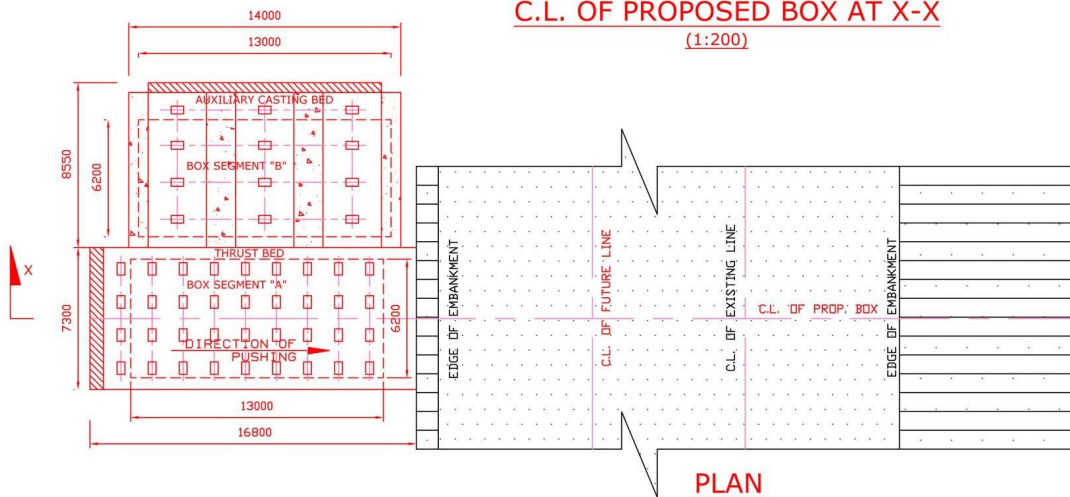


# IMPORTANT SIDE NOTES

- Components of Box Pushing Method:



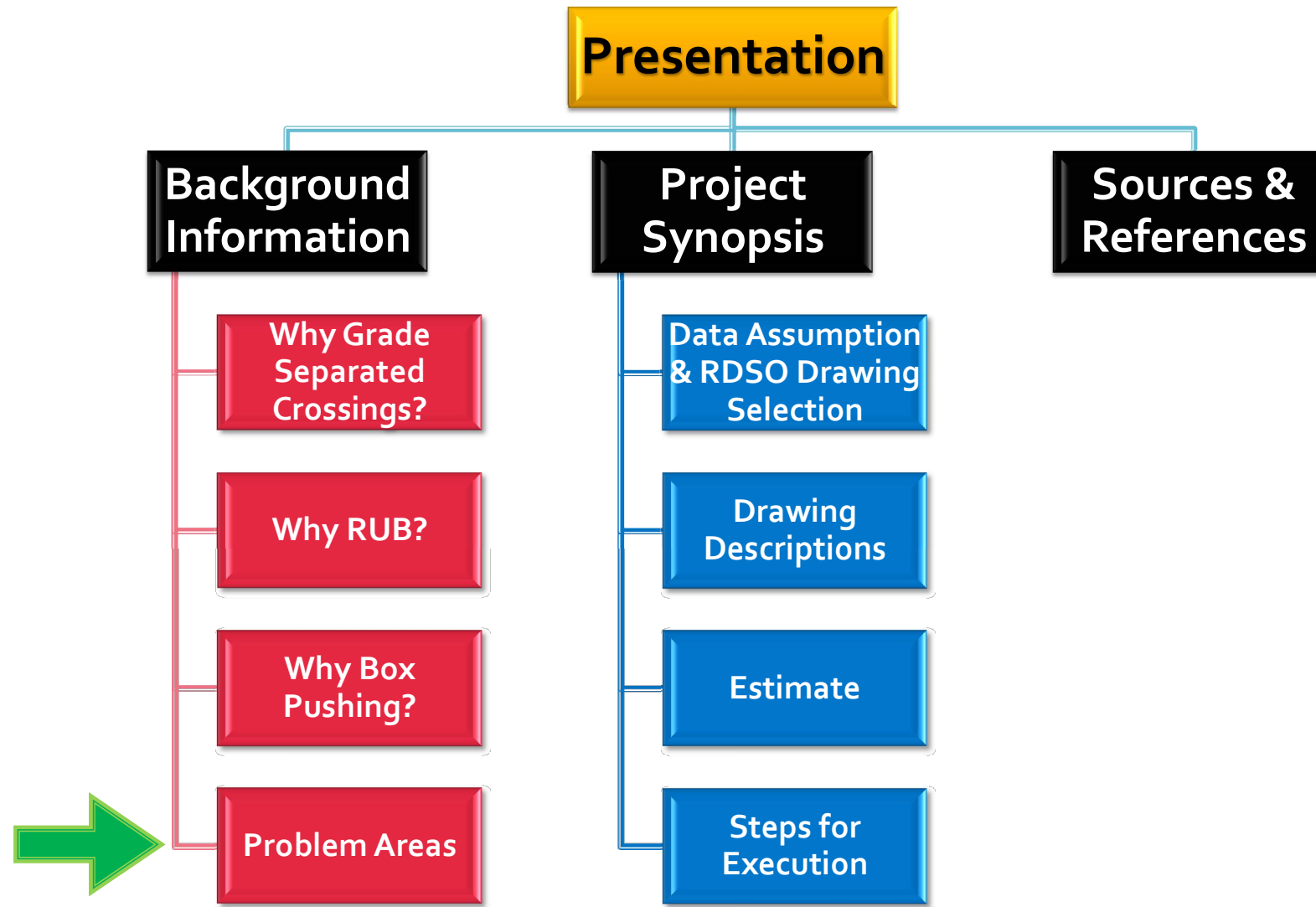
**SECTIONAL ELEVATION ALONG  
C.L. OF PROPOSED BOX AT X-X  
(1:200)**



**PLAN**



# PRESENTATION BLUEPRINT



# PROBLEM AREAS



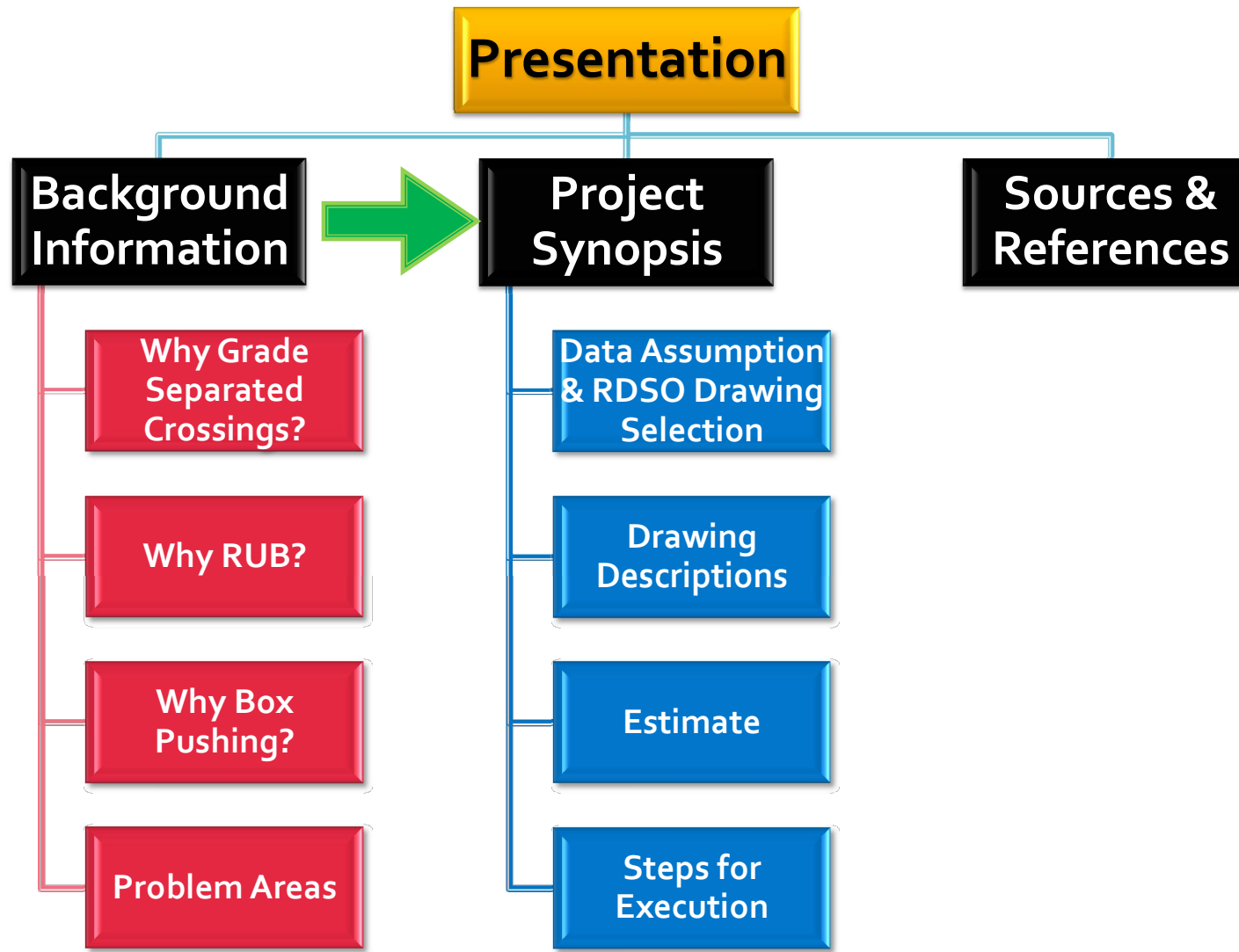
# PROBLEM AREAS

- Construction can get delayed due to delay in consent of State Government for closure of LCs and cost sharing, availability for encroachment free land for approach roads, shifting of utilities, allocation of State funds, lack of coordination from Municipalities, public support etc.
- Public outrage during closure of Level Crossings
- Requirement of very skilled labor
- Constant vigilance of level and center line so that box does not get tilted/shifted from desired orientation, rectification of which, otherwise is difficult
- Difficult to construct in rocky strata
- Possibility of encountering collapsible strata
- Leak in joints
- Failure of pin pocket
- In absence of proper lighting, it can be inconvenient to access especially for pedestrians
- Not suitable for passage of Heavier vehicles or vehicles with height more than clearance height
- Frequent flood in subway in absence of proper drainage

# TOP PRECAUTIONARY MEASURES

- While cutting bank for construction of main thrust bed, necessary **protection of bank** to be done against slip of bank materials as per site condition with the approval of engineer in charge
- **RPF and GRP** to be made available in case of Public Outrage due to LC closure
- Cutting edge should be fabricated with adequate thickness of steel plate with **sharpened front edge** to facilitate penetration into soil
- Cutting edge should be **projected more at top** with respect to bottom slab to prevent earth falling from top during excavation
- The friction between drag sheets & box can be reduced by **applying grease** to drag sheets
- **Guide channels** to be provided in the thrust bed to guide segments to ensure straight alignment
- **Support is provided under the rail sleepers** in case the cushion under ballast collapses due to loose soil while pushing the box
- Measures should be taken to **restrict train speed** during passage over bridge while work is in progress
- Jacks should be tested before using at the time of pushing and in case of failure of jack, four **standby jacks** of adequate capacity shall be kept ready at site while pushing the RCC box
- **Extra steel plate** should be provided as per requirement at the jacking pocket of RCC box
- Average rate of pushing shall not ideally be more than **1m in 24 hours**
- To prevent settlement, murrum/quarry dust to be used as **backfilling** in gaps
- **Height gauge** shall be provided on either side of rub at a distance of 5.0m or as per site condition from the outer face to safeguard of top slab R.C.C. Box from getting hit by vehicles
- **Railway Board Letter** number 2017/CE-IV/RUB/88 dated 24.09.2019 (Instrn. No. 28/2019) to be followed in the context of waterlogging problem, etc.

# PRESENTATION BLUEPRINT



# PROJECT SYNOPSIS: DATA ASSUMPTION & RDSO DRAWING SELECTION

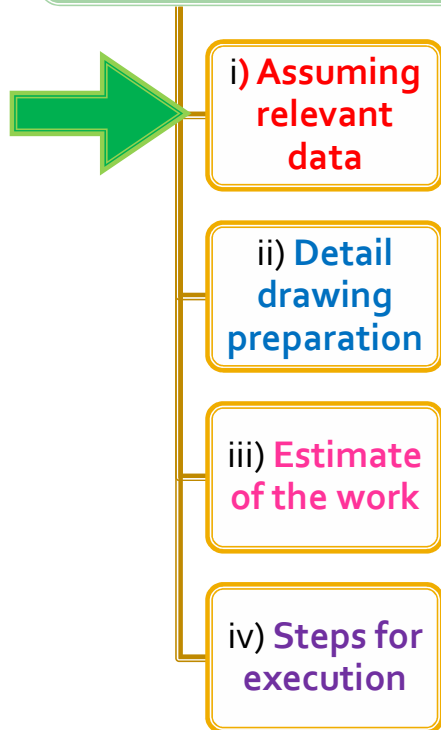
“Prepare detail drawing, estimate & steps for execution of Construction of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (Assuming relevant data)”

# PROJECT SYNOPSIS: DATA ASSUMPTION & RDSO DRAWING SELECTION

“Prepare **detail drawing, estimate & steps for execution of Construction** of Normal height subway (5m x 5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”

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“Prepare **detail drawing**, **estimate** & **steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”



## Step #1:

We are going to first assume relevant data, which are as follows:

- Loading considered is **25T-2008**, Concrete mix is **M35**
- For a barrel length of **26.0 m**, **2 nos. x 13.0m R.C.C. box segments** are used
- There is a **0.950 m earth cushion** between track ballast bottom & top of RCC box top slab
- Thrust bed dimensions (**16.8m x 7.3m x 0.75m**) with **36nos. pockets** of size (**0.64m x 0.6m x 0.4m**) & Auxiliary bed dimensions (**14.0m x 8.55m x 0.75 m**) with **12 nos. pockets** of size (**0.64m x 0.6m x 0.4m**) are compatible with the soil safe bearing capacity as well as providing adequate jacking force to thrust **2 nos. R.C.C. box segments** of size (**13.0m x 5.15m x 5.0m**) and thickness **0.600m** through the embankment
- Thrust wall (**0.7mx0.6m**), Front key(**1mx1.5m**), middle key(**0.7mx1.5m**) and rear key(**1mx2m**) dimensions are assumed
- Longitudinal section of the site is assumed to be uniformly rolling downwards with a **slope of 1:30** in both directions of the RUB along its barrel length, symmetrically, for ease of drawing
- Proposed approach road level is assumed to rise uniformly with a **slope of 1 in 31.3** (less than recommended 1:20, to prevent waterlogging) in both directions of the RUB along its barrel length symmetrically, for ease of drawing
- Key plan components, location details, existing Rail level, existing Formation level, Existing ground levels are **fictional**

# DETAIL DRAWING PREPARATION

“Prepare **detail drawing**, **estimate** & **steps** for execution of Construction of Normal height subway (5mx5m inside) on 5m bank height on single line considering the **future provision of double line** using box pushing method with barrel length 26m (**Assuming relevant data**)”

i) **Assuming relevant data**

Step #2:

Parameters: 1) **Single box culvert**, 2) **Double line track upto 4°**, 3) **(5.0mx5.0m) RCC box**, 4) **25T loading** and 5) 1.0 m earth fill (rounding up **0.95m** to 1m)

ii) **Detail drawing preparation**

iii) **Estimate of the work**

iv) **Steps for execution**

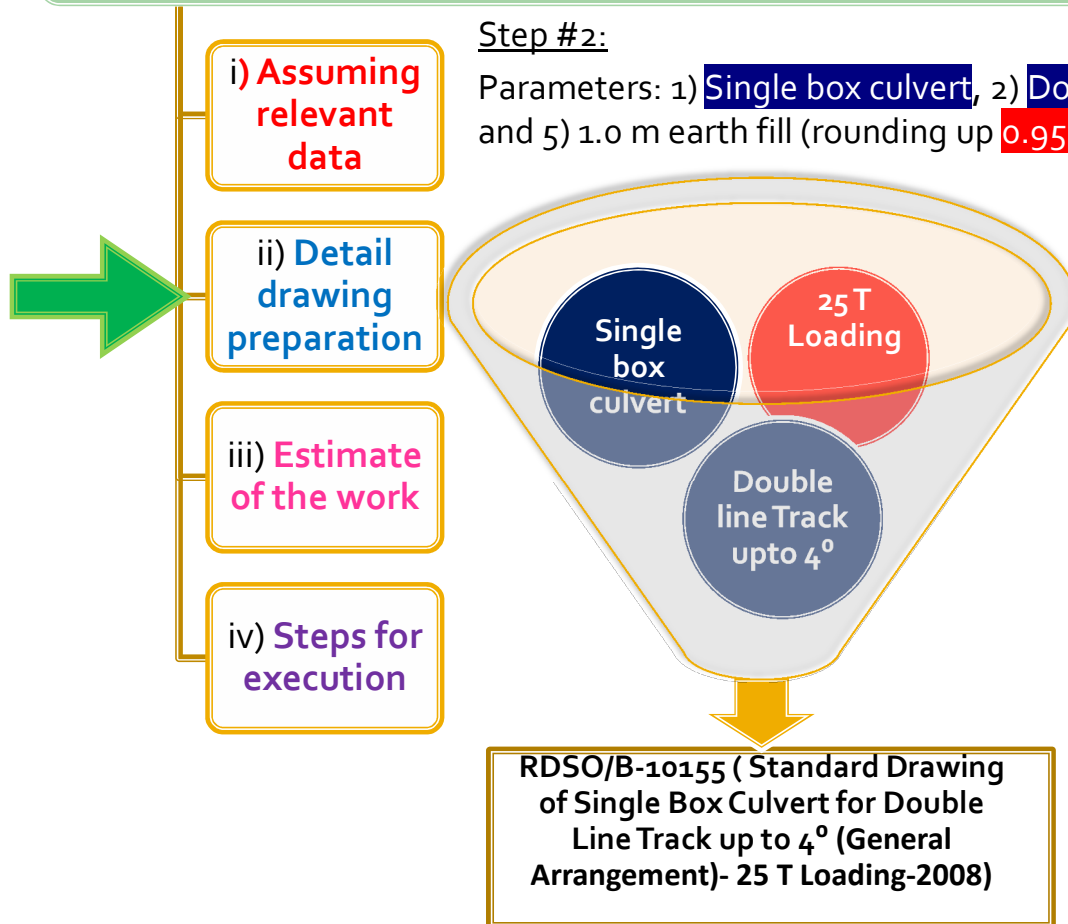


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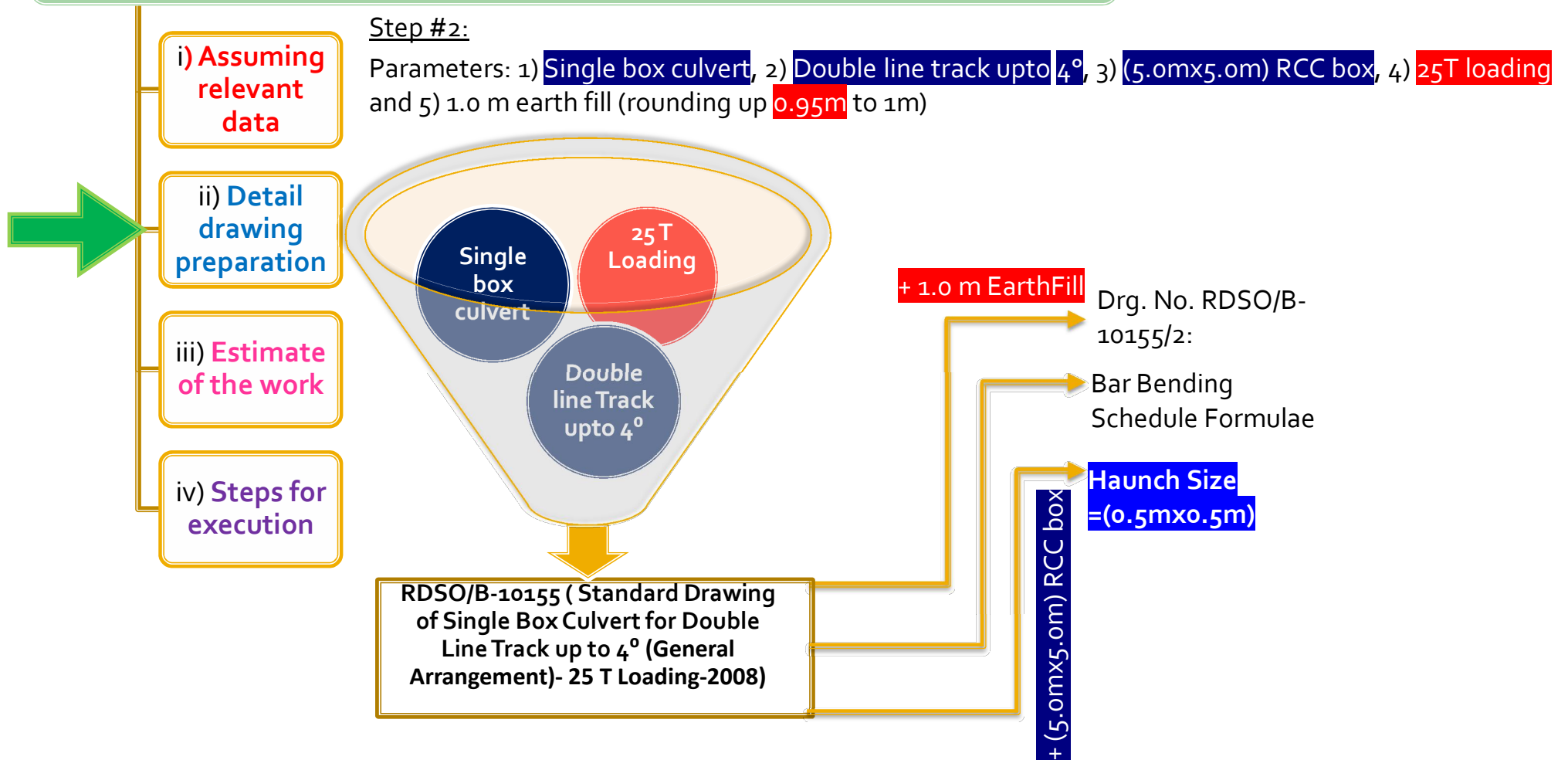


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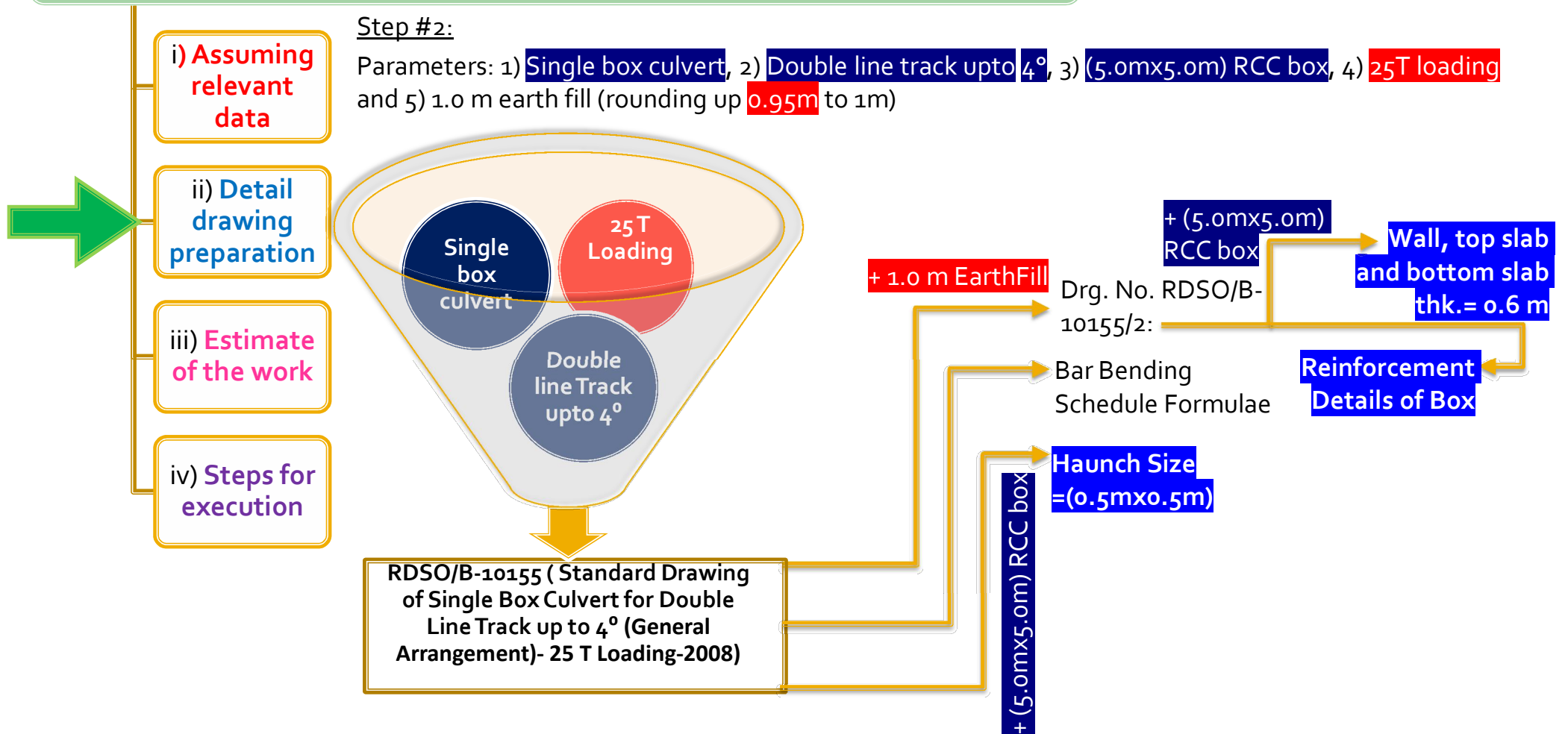
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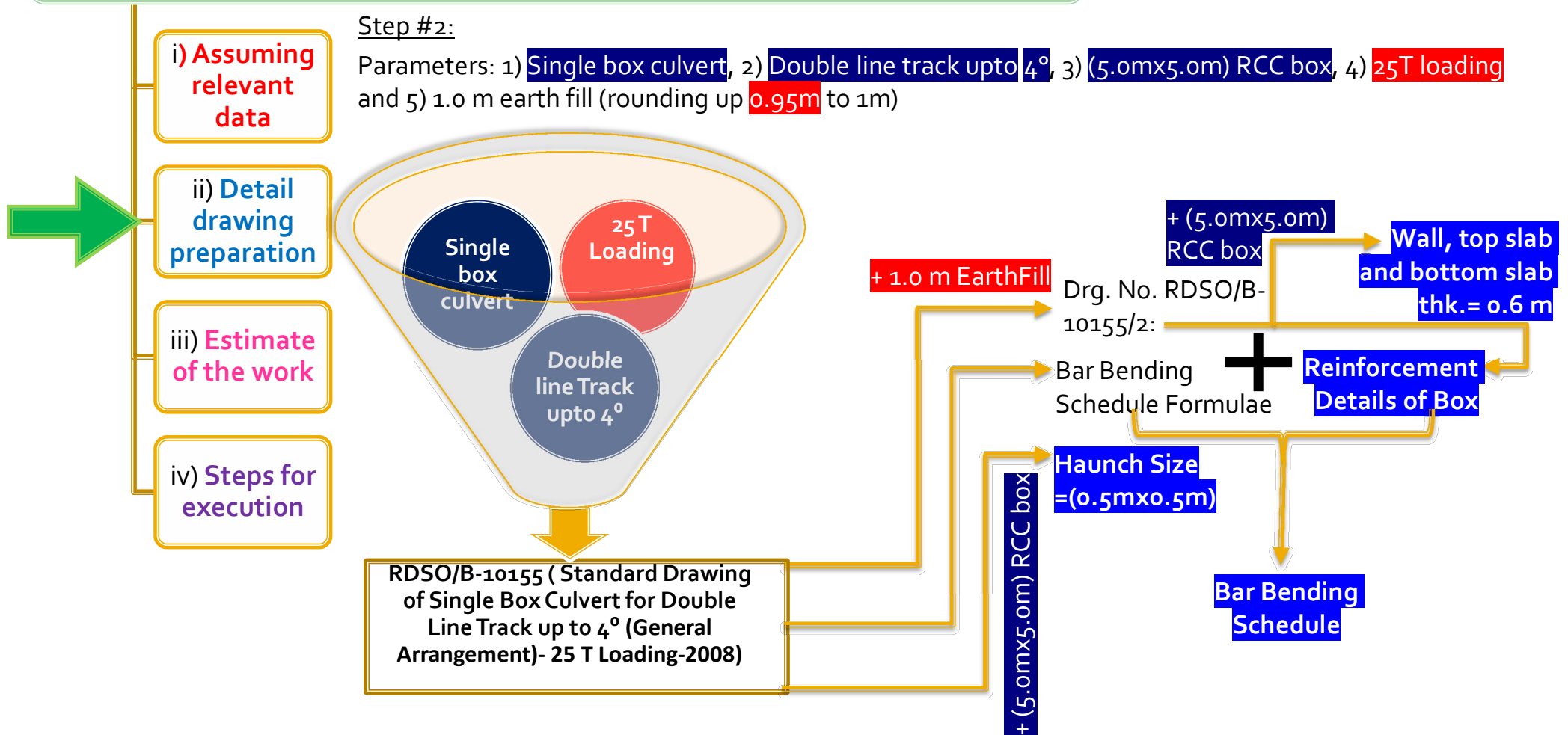
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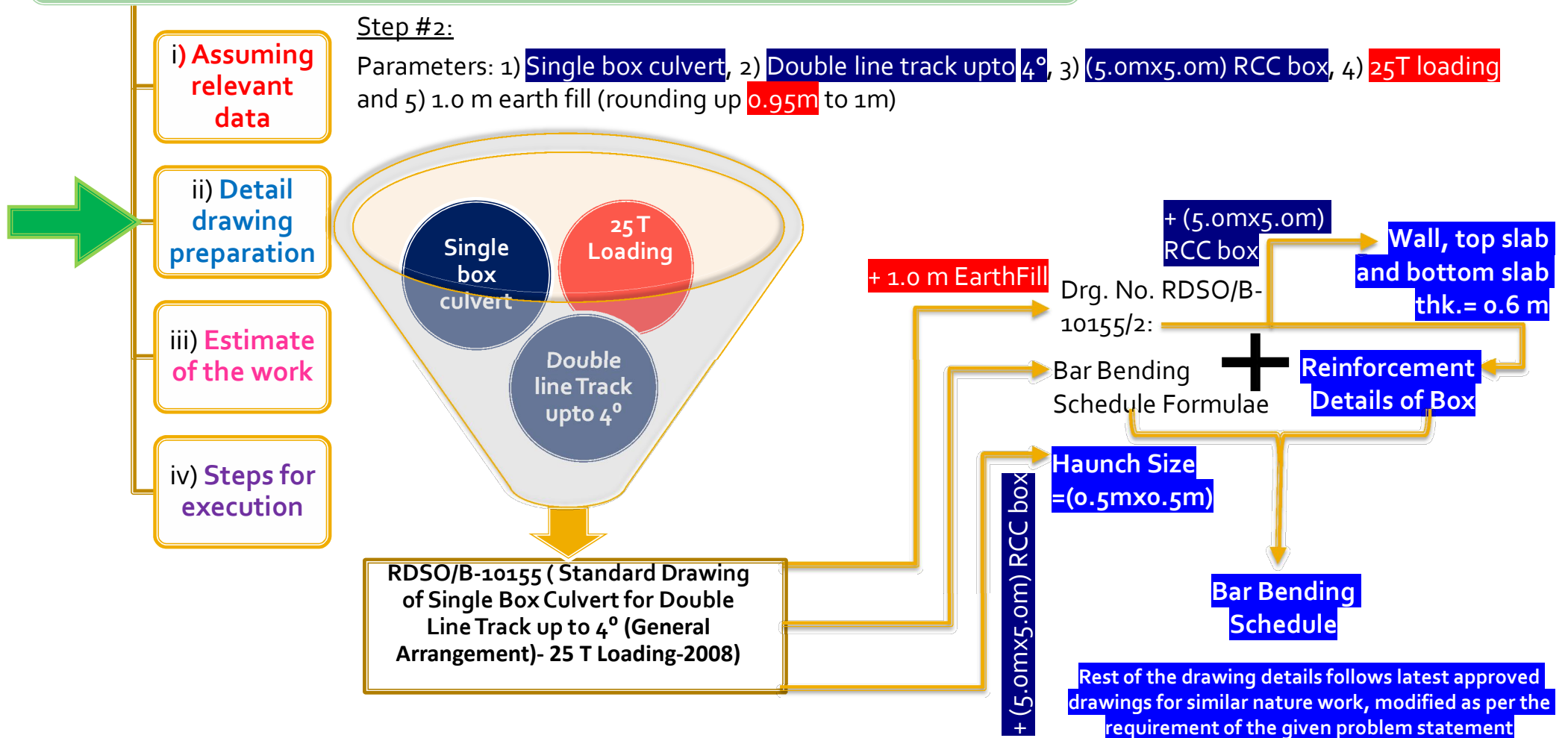
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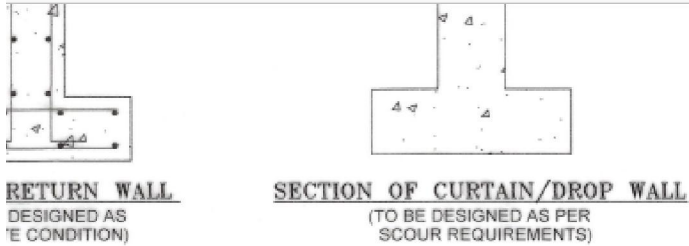


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# DETAIL DRAWING DESCRIPTIONS



AS PER CLAUSE 7.5 OF IRS BRIDGE SUBSTRUCTURE

## REFERENCE DRAWINGS

S.No.	DESCRIPTION	DRAWING NO.
1	0.0 m FILL HEIGHT	RDSO/B-10155/1
2	1.0 m FILL HEIGHT	RDSO/B-10155/2
3	2.0 m FILL HEIGHT	RDSO/B-10155/3
4	3.0 m FILL HEIGHT	RDSO/B-10155/4
5	4.0 m FILL HEIGHT	RDSO/B-10155/5
6	5.0 m FILL HEIGHT	RDSO/B-10155/6
7	6.0 m FILL HEIGHT	RDSO/B-10155/7
8	8.0 m FILL HEIGHT	RDSO/B-10155/8
9	10.0 m FILL HEIGHT	RDSO/B-10155/9
10.	1.0m X 1.2m & 2.0m X 1.2m FOR 0.0m to 10.0m FILL HEIGHT	RDSO/B-10155/10

## TABLE FOR B X B HAUNCH

CLS or cht	SIZE OF HAUNCH	CLS or cht	SIZE OF HAUNCH
LESS THAN 3 m	200 X200 mm	> 4.5 m and < 5.0m	450 X450 mm
> 3.0 m and < 3.5m	300 X300 mm	> 5.0 m and < 5.5m	500 X500 mm
> 3.5 m and < 4.0m	350 X350 mm	> 5.5 m and < 6.0m	550 X550 mm
> 4.0 m and < 4.5m	400X400 mm	> 6.0m	600 X600 mm

## REINFORCEMENT FOR BOX

TYPE	SHAPE	REMARKS
a1		$j = tsv + \max. [0.3 \times \text{eff. span or DL}] - \text{cover}$
a2		$k = tst + \max. [0.3 \times \text{eff. height or DL}] - \text{cover-dia}$
b		
c		$l = tsb + \max. [0.3 \times \text{eff. height or DL}] - \text{cover-dia}$
d		
e		
f1		$m = \max. [0.1m \text{ or DL}] \cdot \sqrt{2} \times tst + \sqrt{2} \times \text{cover}$ $n = \sqrt{2} (B + tst + tsv) - 2 (\sqrt{2} + 1) \text{ cover}$
f2		$m1 = \max. [0.1m \text{ or DL}] \cdot \sqrt{2} \times tsb + \sqrt{2} \times \text{cover}$ $n1 = \sqrt{2} (B + tsb + tsv) - 2 (\sqrt{2} + 1) \text{ cover}$
g1		$p = 10 \phi$ , bent at an angle of $135^\circ$ $s = tst - 2 \times \text{cover} - \text{dia}$
g2		$p = 10 \phi$ , bent at an angle of $135^\circ$ $v = tsb - 2 \times \text{cover} - \text{dia}$
g3		$p = 10 \phi$ , bent at an angle of $135^\circ$ $w = tsv - 2 \times \text{cover} - \text{dia}$
h		

5mX5.0m

25mm DIA @ 200mm

12mm DIA @ 200mm

25mm DIA @ 100mm

16mm DIA @ 200mm

25mm DIA @ 100mm

12mm DIA @ 200mm

25mm DIA @ 200mm

25mm DIA @ 200mm

10mm Dia @ 200mm ALONG BARELL AND @ 200mm ALONG SPAN

10mm Dia @ 200mm ALONG BARELL AND @ 200mm ALONG SPAN

10mm Dia @ 200mm ALONG BARELL & @ 200mm ALONG HEIGHT

10mm DIA @ 100mm

60cm







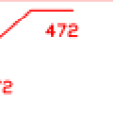

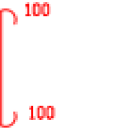
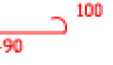

60cm

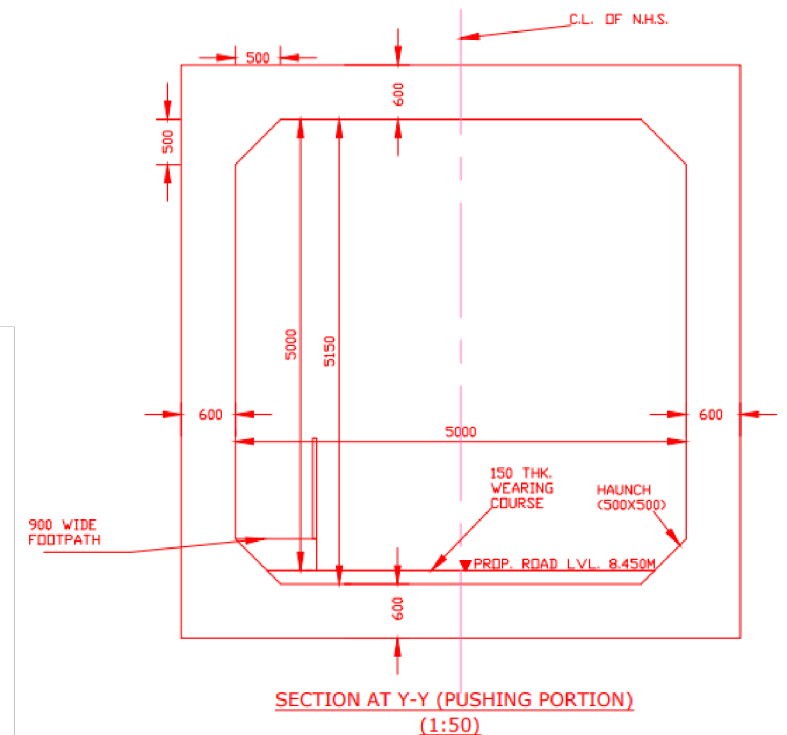
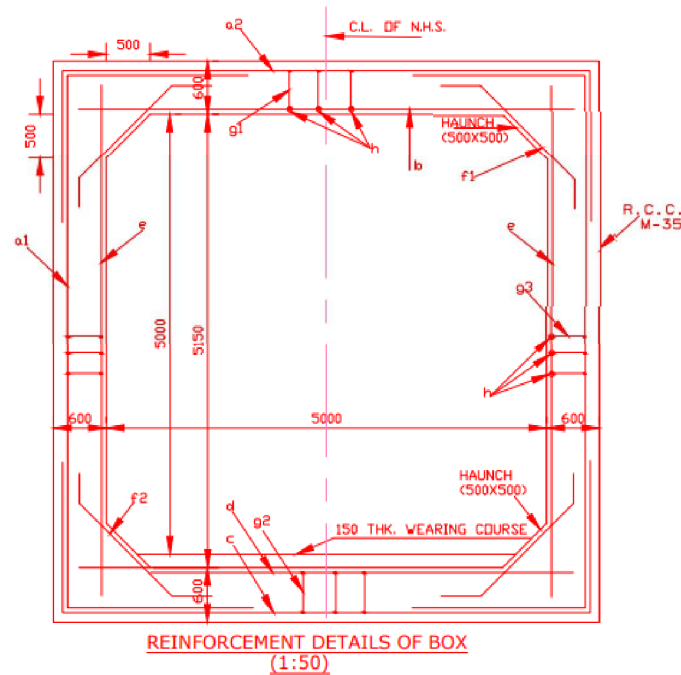
60cm

220 kN/m<sup>2</sup>

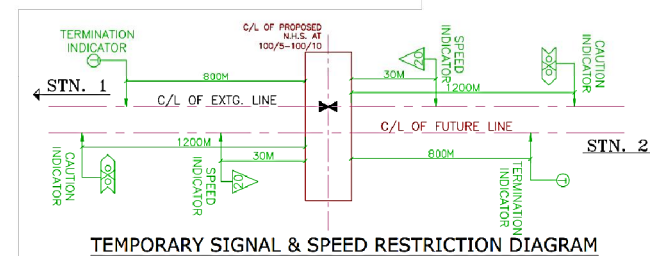
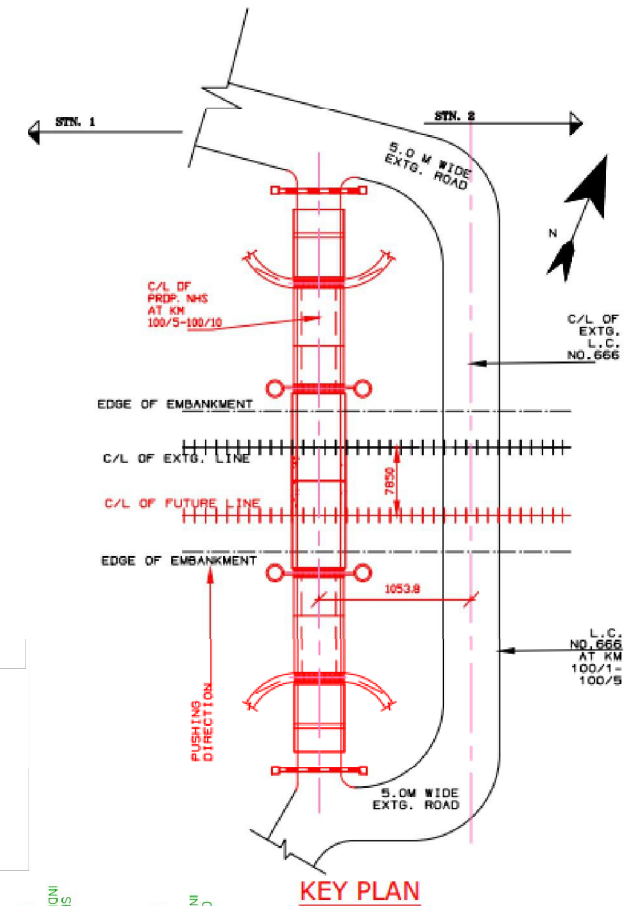
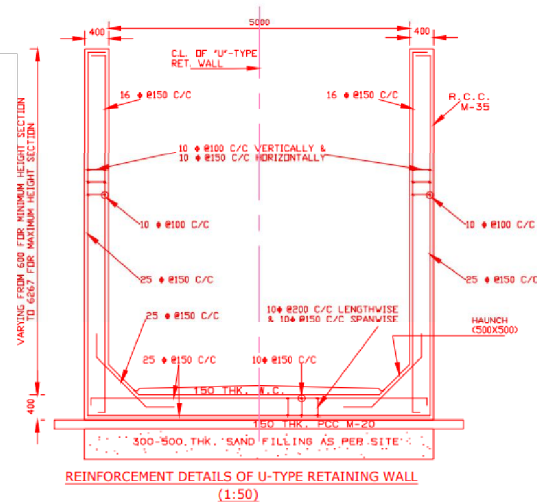
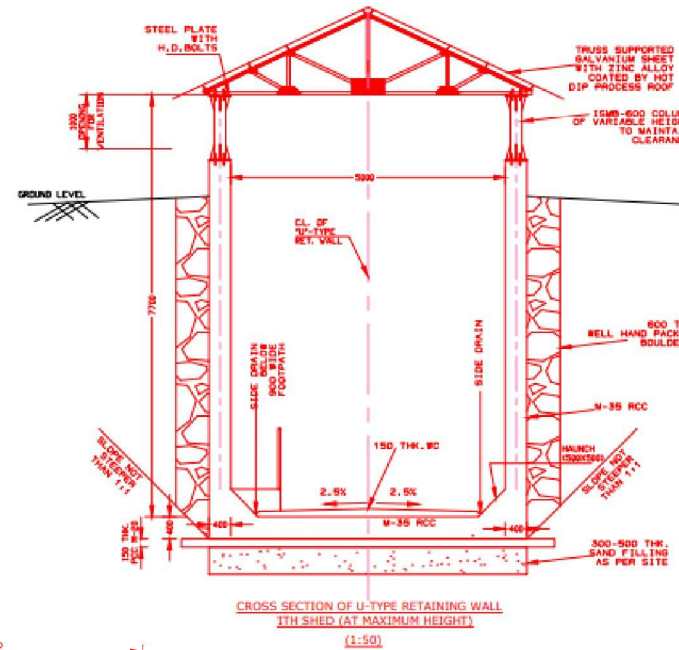
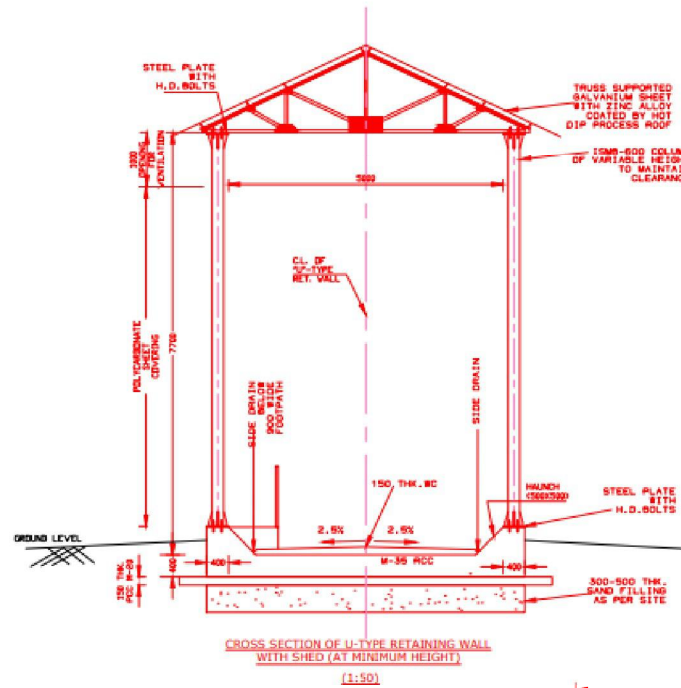
# DETAIL DRAWING DESCRIPTIONS: SHEET 1 OF 4

BAR BENDING SCHEDULE OF R.C.C. BOX

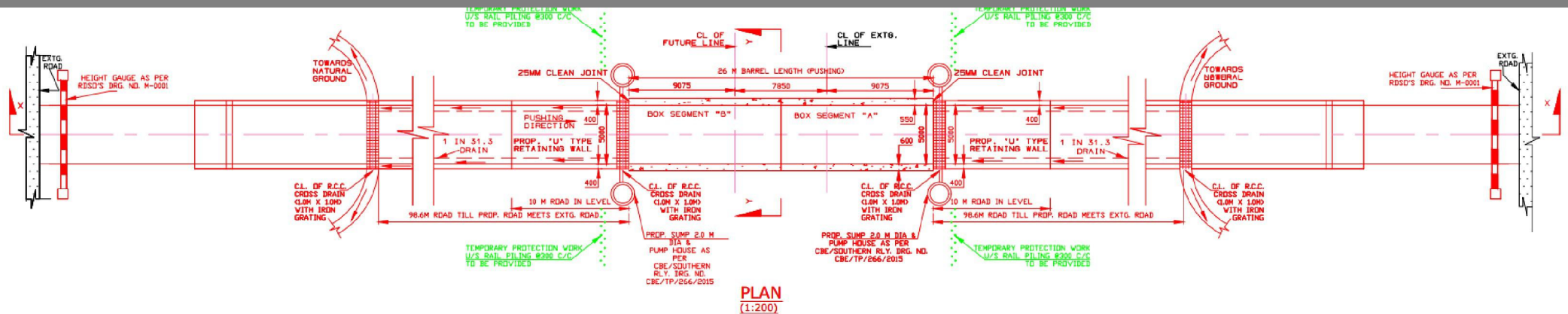
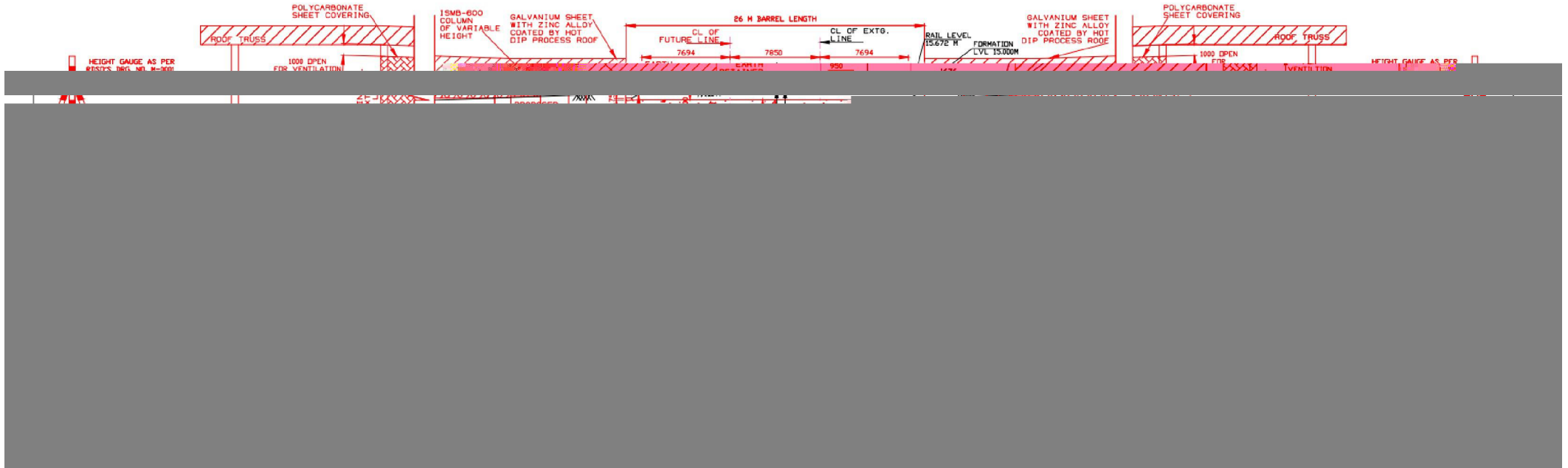
BAR MARKS	SHAPE OF BAR	DIA OF BAR	SPACING
a1		25 mm $\phi$	200 mm c/c
a2		12 mm $\phi$	200 mm c/c
b		25 mm $\phi$	100 mm c/c
c		16 mm $\phi$	200 mm c/c
d		25 mm $\phi$	100 mm c/c
e		12 mm $\phi$	200 mm c/c
f1		25 mm $\phi$	200 mm c/c
f2		25 mm $\phi$	200 mm c/c
g1 g2		10 mm $\phi$	200 mm c/c ALONG BARREL AND 200 mm c/c ALONG SPAN
g3		10 mm $\phi$	200 mm c/c ALONG BARREL & 200 mm c/c ALONG HEIGHT
h		10 mm $\phi$	100 mm c/c PER BOX SEGMENT



# DETAIL DRAWING DESCRIPTIONS: SHEET 1 OF 4

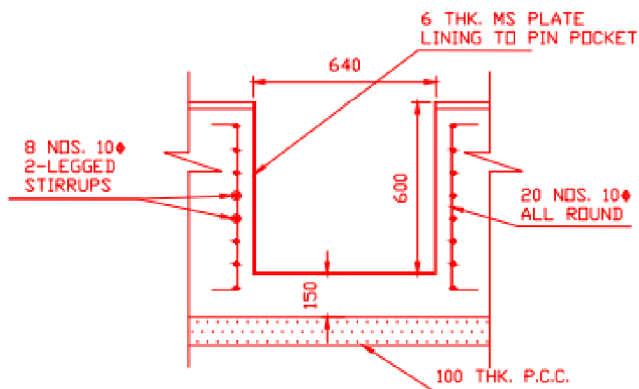


# DETAIL DRAWING DESCRIPTIONS: SHEET 1 OF 4

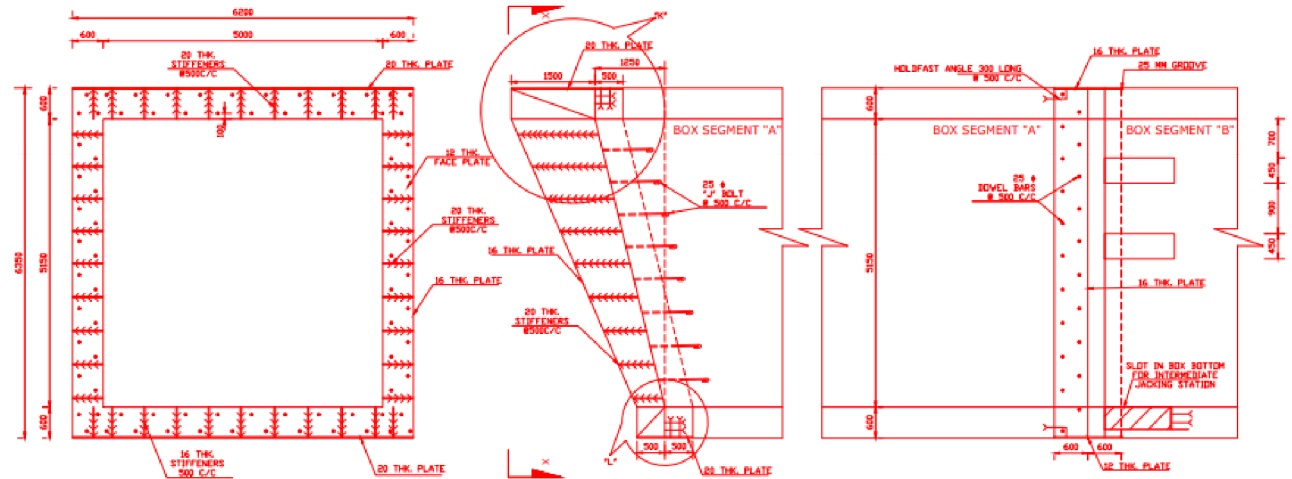




# DETAIL DRAWING DESCRIPTIONS: SHEETS 2 & 3 OF 4



**SECTION W-W**

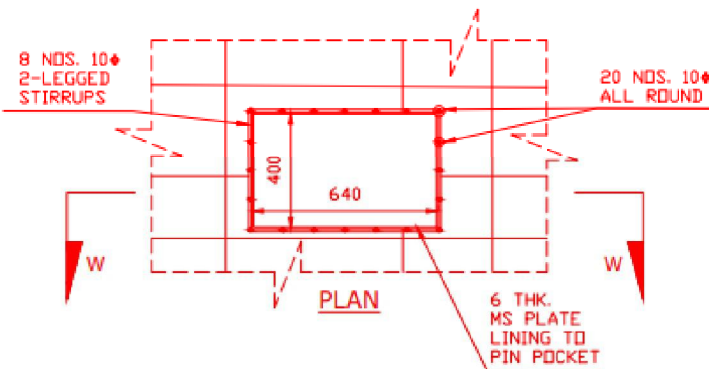


**VIEW X-X: FRONT ELEVATION OF FRONT SHIELD  
(FRONT PORTION OF BOX SEGMENT "A")**

(1:50)

**SECTIONAL SIDE ELEVATION VIEW**

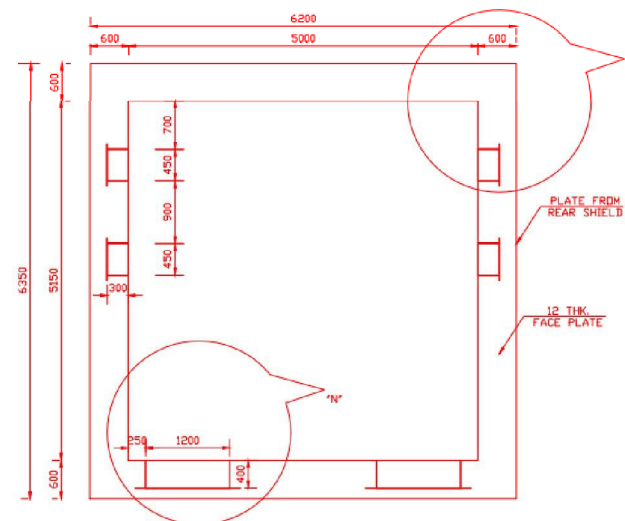
(1:50)



**PLAN**

**TYPICAL REINFORCEMENT AROUND POCKET**

(1:20)



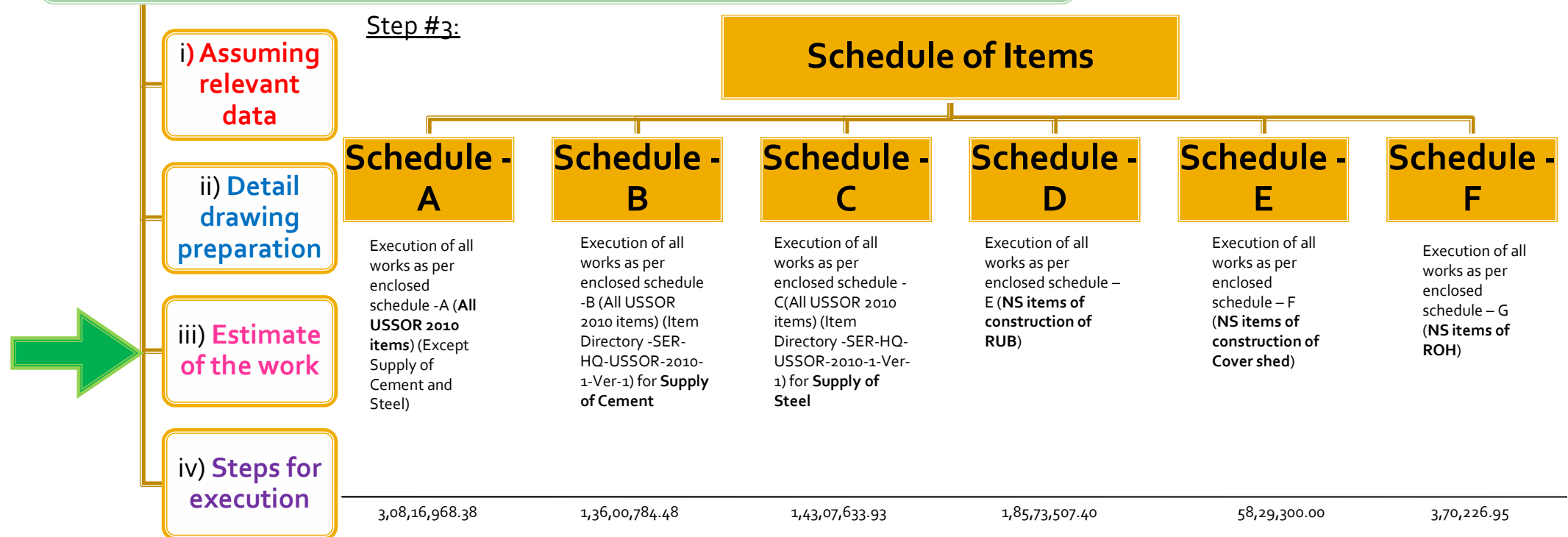
**INTERMEDIATE JACKING STATION  
(FRONT PORTION OF BOX SEGMENT "B")**

(1:50)

n.b.: SHEET 4 OF 4 CONTAINS STEPS FOR EXECUTION OF CONSTRUCTION WHICH WILL BE DESCRIBED LATER

# ESTIMATE OF THE WORK

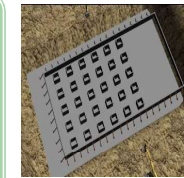
“Prepare **detail drawing, estimate & steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”



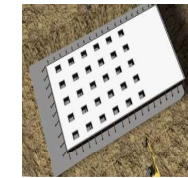
As per above Estimate calculation, based on Drawing Dimensions for this work and following other previous similar works (Tender No: CKP-SOUTH-19-20-57) (excluding some non-Civil work items like Geotagging, advertisement cost, S&T, TRD, etc), the cost of the entire work has been estimated to be INR **8,34,98,421.14/-**  
 On adding various other miscellaneous works, the total cost for this project was estimated to be INR **10,75,66,653.00/-**

# STEPS FOR EXECUTION OF CONSTRUCTION

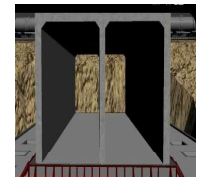
“Prepare **detail drawing**, **estimate** & **steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”



1. Excavation, shoring and reinforcement placement



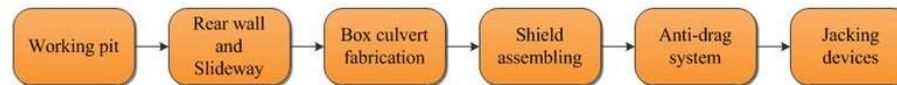
2. Casting of Thrust bed and Auxiliary Bed



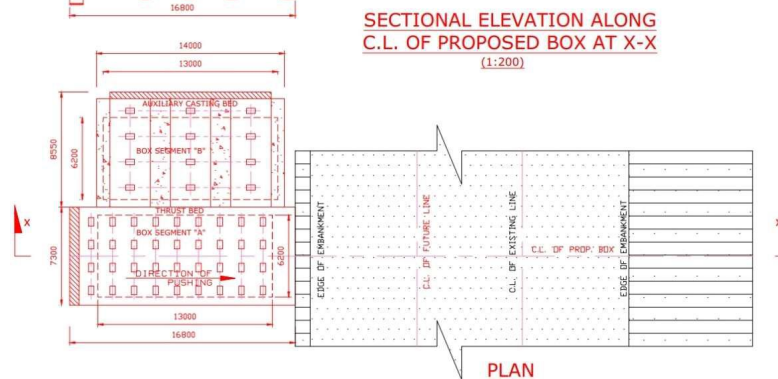
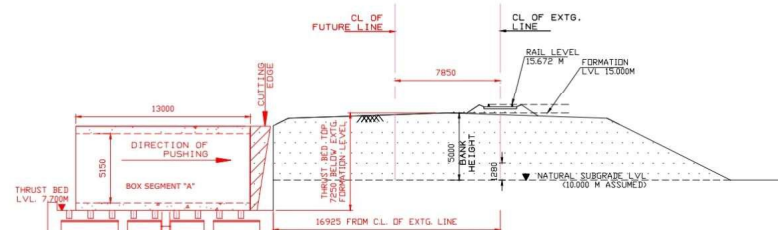
3. In situ casting of RCC boxes

## Step #4:

As seen in Sheet-4 of 4, following are the steps for execution of construction-



Preparatory stage



PLAN

i) **Assuming relevant data**

ii) **Detail drawing preparation**

iii) **Estimate of the work**

iv) **Steps for execution**



## 1) **Pre-Jacking Operations:**

### A) Excavation:

Followed by Temporary structural protection shoring work will be taken up for construction of thrust bed if required as per site condition as per standard drawings.

### B) Construction of Thrust and Auxiliary Bed:

1. Desired Location and Level are fixed and 100 mm thick PCC is laid.

2. Reinforcement for Thrust Bed and Auxiliary Bed keeping provision for Pockets size and numbers are set up. Casting of Thrust Bed and Auxiliary Bed is done next

### C) Casting of RCC Block segments:

1. Reinforcement Arrangements are set up for RCC box segments as per required dimensions

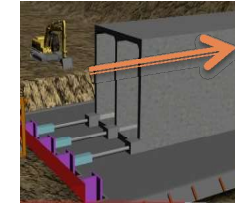
2. Box segment "A" is cast over main thrust bed and cast segment "B" over auxiliary thrust bed.

3. Cutting shield is fixed in front of Segment "A".

4. Drag Sheets, Jacks and all machineries set in position, everything set up for jacking to be initiated.

# STEPS FOR EXECUTION OF CONSTRUCTION

“Prepare **detail drawing, estimate & steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”



4. Fixing of Jacks and Pushing initiation

## 2) Jacking Operations:

### A) Solo Pushing of Box segment “A”:

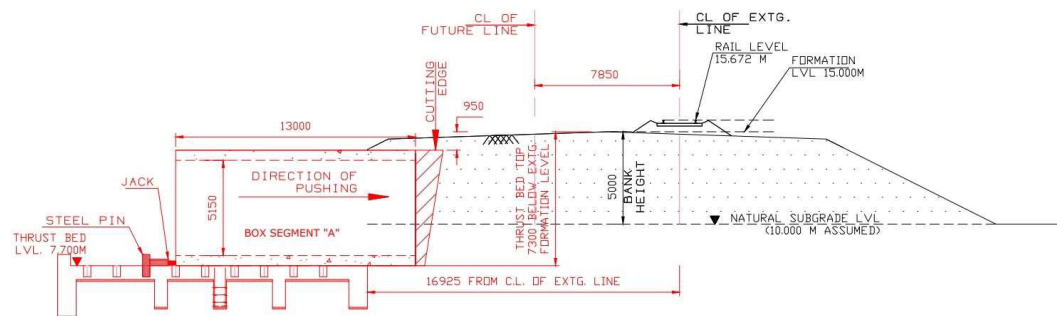
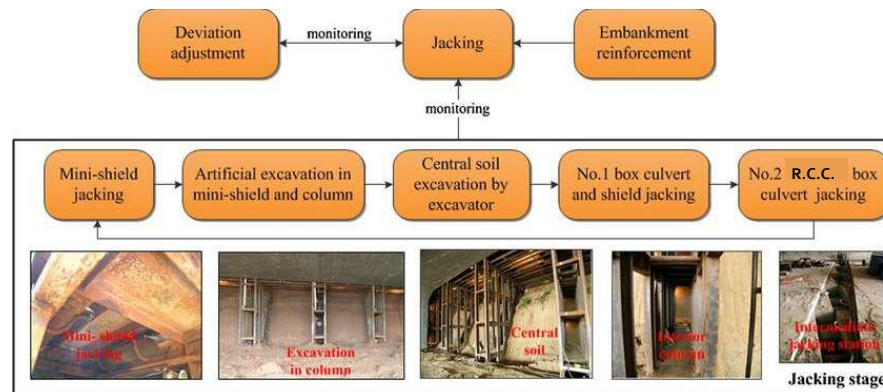
1. Pushing forward of front unit with the help of hydraulic jack over thrust bed until the shield tip reaches near the toe of embankment .
2. The front unit is jacked from rear, taking reaction from thrust bed and pin pockets using spacers, till the shield tip enters into the soil mass .
3. Excavation is started on shield face from inside of RCC box matching with shield front edge, then the front unit is pushed from rear as previous until approximately 50% length of front unit enters into the soil mass.

i) **Assuming relevant data**

ii) **Detail drawing preparation**

iii) **Estimate of the work**

iv) **Steps for execution**



**JACKING OPERATION (STAGE- 2)**

**SECTIONAL ELEVATION ALONG C.L. OF PROPOSED BOX AT X-X (1:200)**

1. PUSHING SEGMENT “A” FORWARD BY HYDRAULIC JACK TAKING SUPPORT FROM THRUST WALL AND PIN-POCKETS.

# STEPS FOR EXECUTION OF CONSTRUCTION

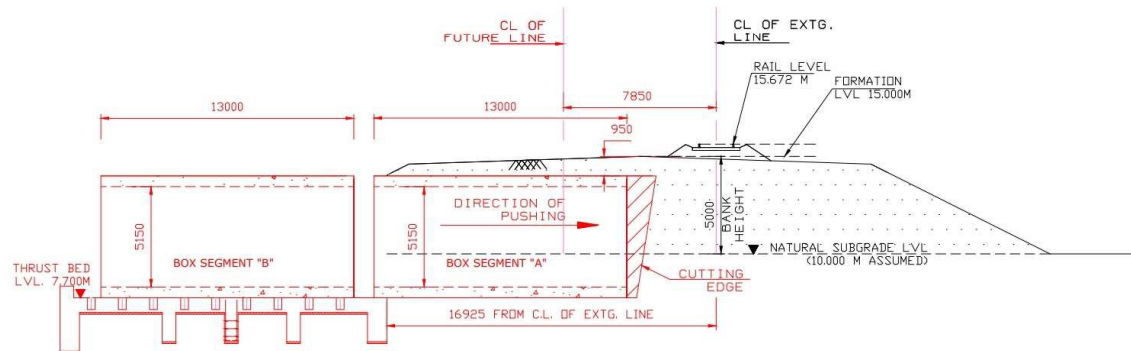
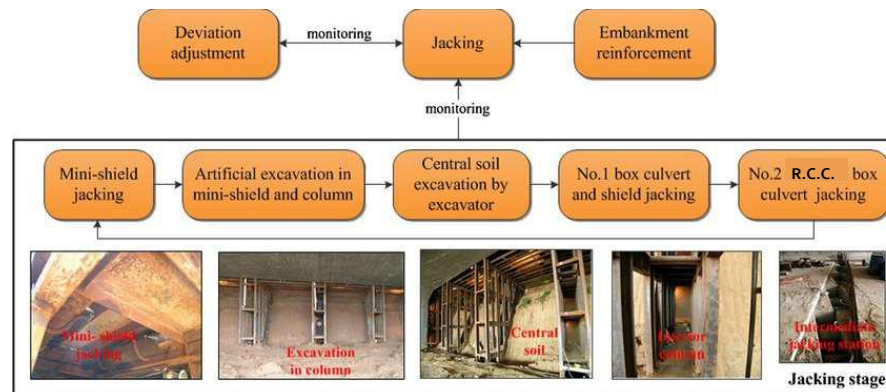
“Prepare **detail drawing, estimate & steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”

i) **Assuming relevant data**

ii) **Detail drawing preparation**

iii) **Estimate of the work**

iv) **Steps for execution**



**JACKING OPERATION (STAGE- 3)**

**SECTIONAL ELEVATION ALONG C.L. OF PROPOSED BOX AT X-X (1:200)**

1. PUSHING SEGMENT "B" SIDEWAYS FROM AUXILIARY THRUST BED TO MAIN THRUST BED.
2. CONNECT BOTH THE SEGMENTS BY REAR SHIELD.

2) B) Slewing of Box Segment "B" from Auxiliary bed to Jacking location on Thrust Bed:

- 1. Starting of sideways moving of box segment unit "B" over thrust bed until its front recess portion enters inside the IJS shield plate at rear of the front unit.

# STEPS FOR EXECUTION OF CONSTRUCTION

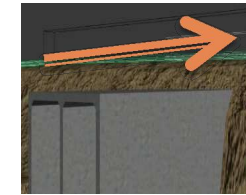
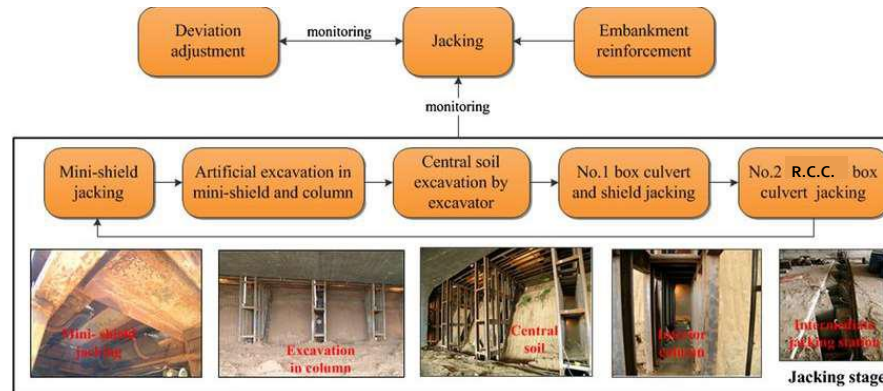
“Prepare **detail drawing, estimate & steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”

i) **Assuming relevant data**

ii) **Detail drawing preparation**

iii) **Estimate of the work**

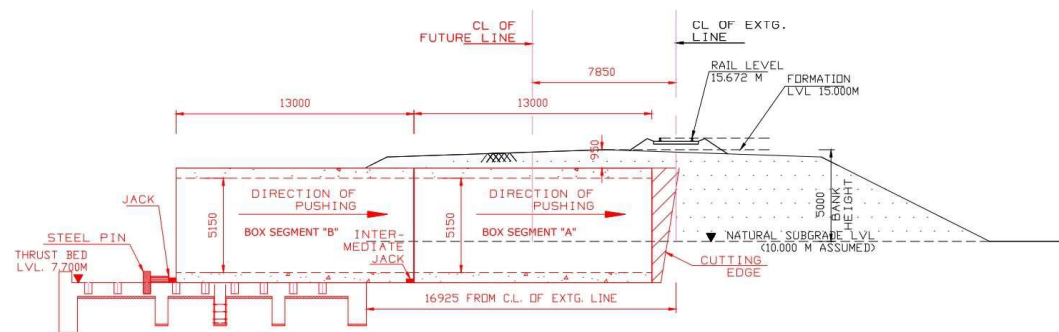
iv) **Steps for execution**



5. Continuation of Pushing the entire barrel Length

2) C) Combined Jacking of Box Segments “A” and “B”:

- 1. Continuation of excavation on shield face as previous and jacking/pushing of the box segments "A" and "B" @ 0.7m - 1m/24 hours, until the two segments reach their exact final position below the railway embankment.
- 2. During operation, level and alignment of jacked boxes have to be checked regularly with the help of levelling instruments and theodolite to keep line and level perfect for minor adjustment. During jacking, only specific jacks in IJS will be used as per requirement and contractor's standard practice



**JACKING OPERATION (STAGE- 4)**

**SECTIONAL ELEVATION ALONG C.L. OF PROPOSED BOX AT X-X (1:200)**

1. NOW PUSH IN FORWARD DIRECTION BOTH THE SEGMENTS "A" AND "B" BY INTERMEDIATE JACKING STATION AND JACK ON MAIN THRUST BED SIMULTANEOUSLY.



# STEPS FOR EXECUTION OF CONSTRUCTION

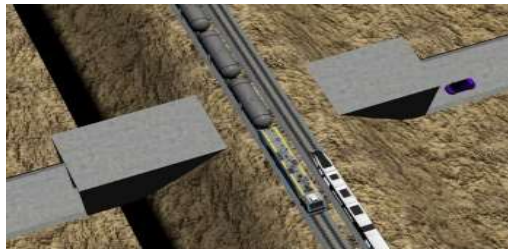
“Prepare **detail drawing**, **estimate** & **steps for execution of Construction** of Normal height subway (5mx5m inside) on 5m bank height on single line considering the future provision of double line using box pushing method with barrel length 26m (**Assuming relevant data**)”

i) **Assuming relevant data**

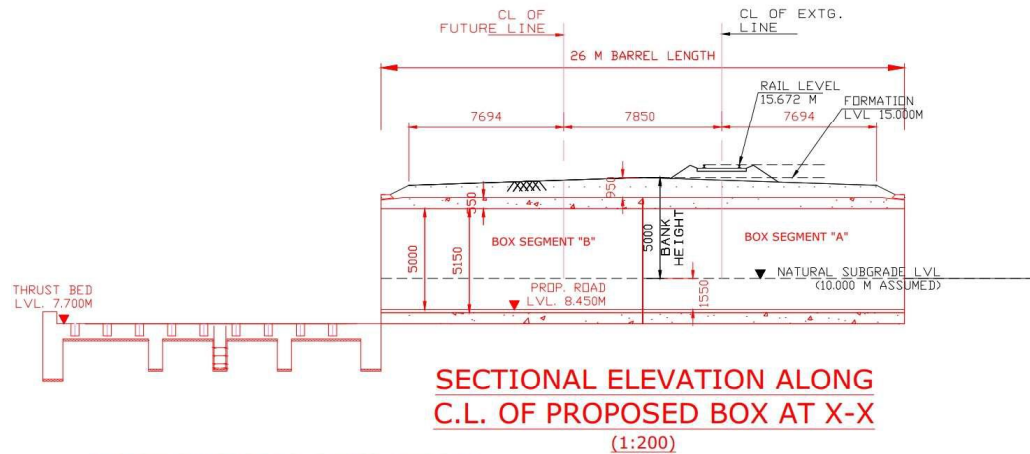
ii) **Detail drawing preparation**

iii) **Estimate of the work**

iv) **Steps for execution**



6. Finishing works and opening the Subway for public use



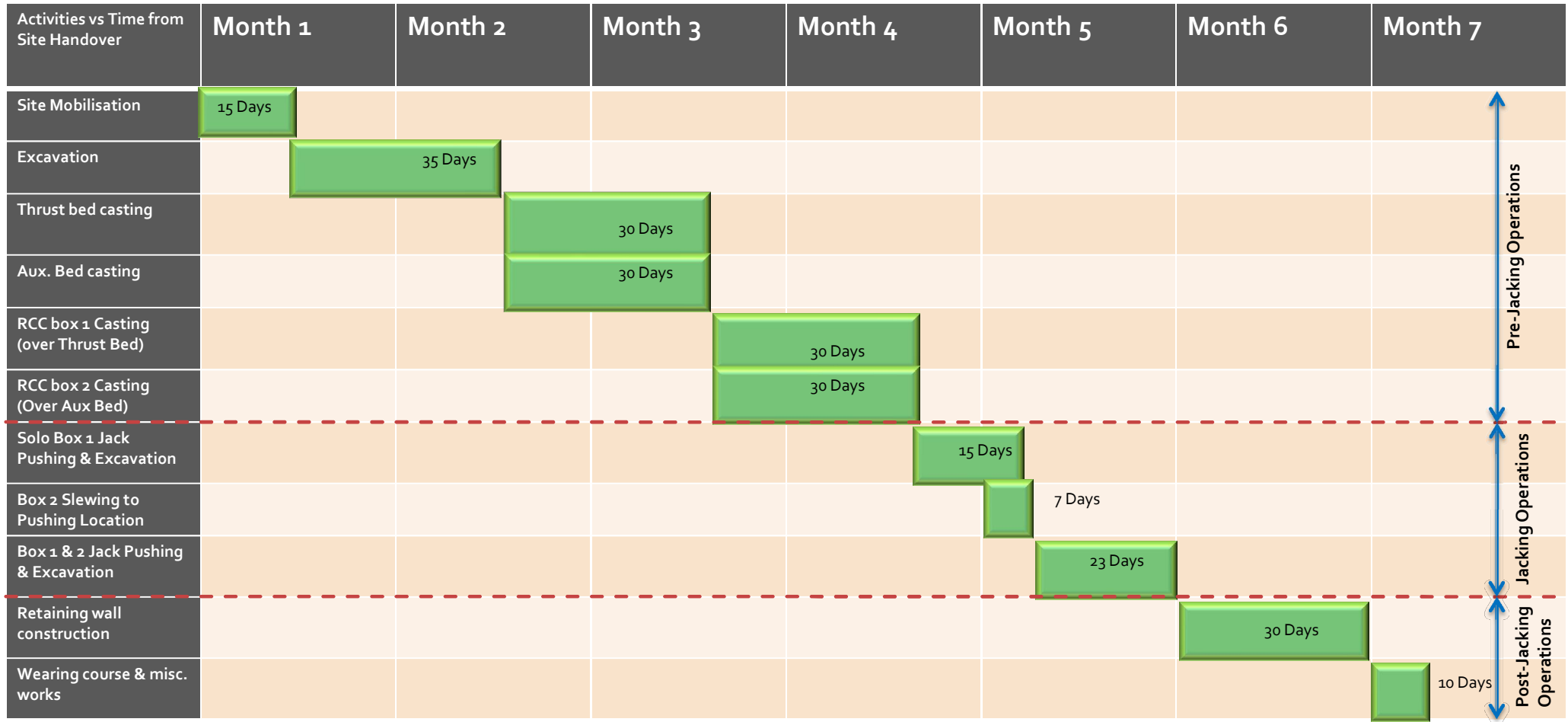
## POST JACKING OPERATION (STAGE- 5)

1. AFTER REACHING THE FINAL POSITION EXCAVATE THE EARTH AND REMOVE THE CUTTING EDGE AND JACKS.
2. FILL THE IJS WITH SAME GRADE OF CONCRETE.
3. SEAL THE JOINTS BETWEEN TWO SEGMENTS "A" AND "B".

## 3) Post-Jacking Operations:

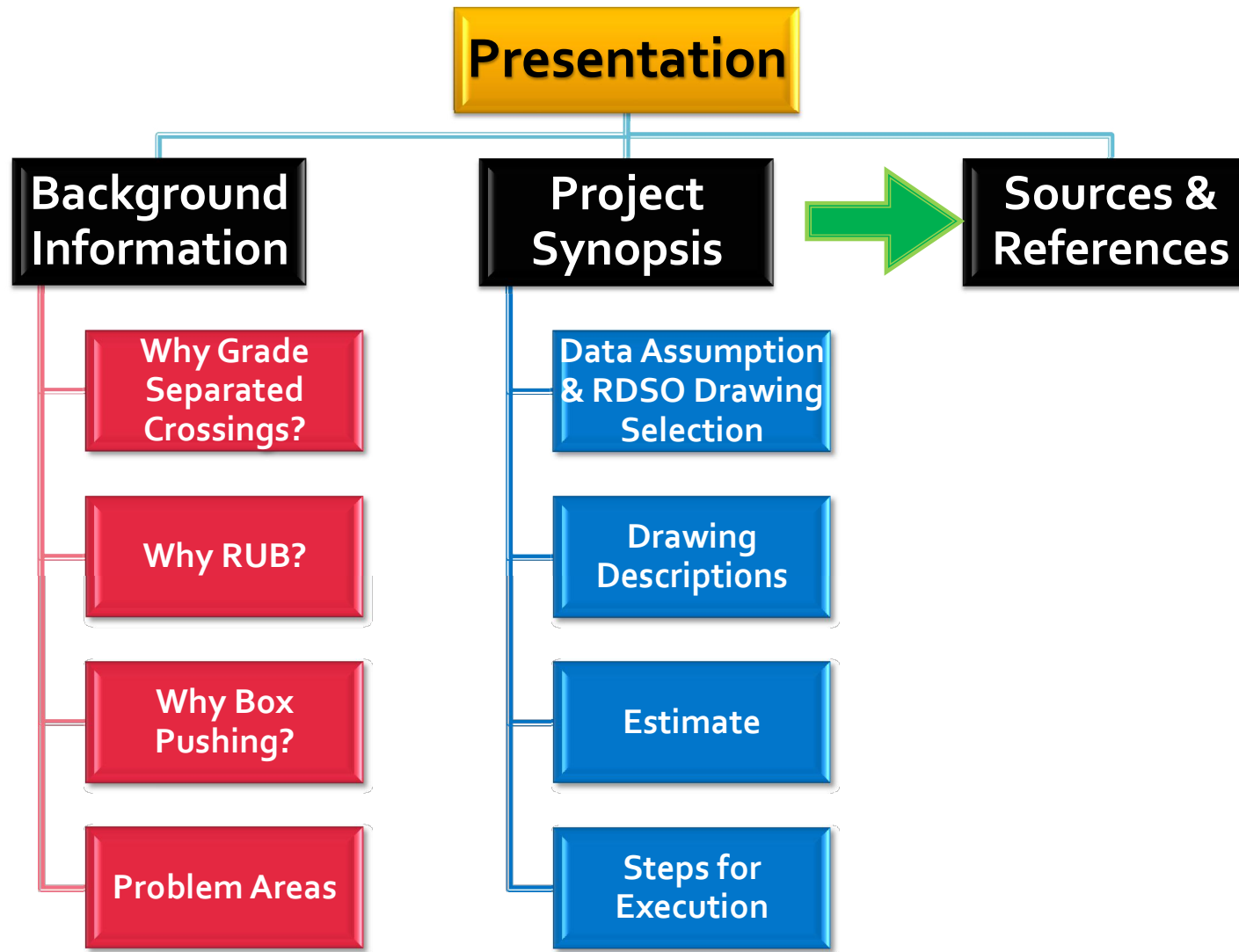
- 1. After reaching the final position, earth is excavated and jacks and cutting edge are removed.
- 2. After completion of jacking, the joints between the two successive boxes will be sealed properly with same grade of concrete (M35).
- 3. Speed restriction to be imposed in sequence over the track as the box pushing progresses from one direction as per the direction of the railway engineer.
- 4. Other Miscellaneous works are executed like, retaining wall and approach road construction, wearing course laying, drainage system arrangement etc.

# STEPS FOR EXECUTION OF CONSTRUCTION



Expected time of completion, assuming convenient conditions of weather etc.:  $15+35+30+30+15+2+23+30+10=190$  days from handing over of site to contractor.

# PRESENTATION BLUEPRINT



# SOURCES

1. Drawing No. RDSO/B-10155: For Standard Drawing of Single box culvert for double line track upto 4° (General Arrangement)
2. Drawing No. RDSO /B-10155/2: For Structural Design Details of (5.0mx5.0m) RCC single box culvert for Double Track with 25T loading and 1.0 m earth fill
3. Approved Drawings for Reference:
  1. Sheet 1: GAD : DRM(ENGG'S) DRG. NO.-20364/KGP/2021  
"Proposed Normal Height Subway span 1x7.5mx5.1m R.C.C. Box at KM 167/2-167/4 in lieu of L.C. No. 90 on KGP-TATA Section for improvement of road connectivity by Pushing Method. (With the help of Relieving Girder)"
  2. Sheet 1: GAD : DRM(ENGG'S) DRG. NO.-20296/KGP/2020  
"Proposed Road Under Bridge (RUB) span 1x5.0 mx5.0 m at KM 228/5-7 between GUD-RHE on KGP-TATA Section by Box Pushing Method. (With the help of Relieving Girder)"
  3. Sheet 2: Reinforcement Details of Thrust Bed and Auxiliary Thrust Bed : BR/SUB/28271/20 sh-2  
"Proposed Normal Height Subway span 2x5.0mx5.0m R.C.C. Box at KM 124/29-31 in lieu of L.C. No. 60 between Kalaikunda-Sardiha stations on KGP-TATA Section for improvement of road connectivity by Pushing Method. (With the help of Relieving Girder)"
  4. Sheet 3: Details of Cutting and Rear Shield: BR/SUB/28271/20 sh-3  
"Proposed Normal Height Subway span 2x5.0mx5.0m R.C.C. Box at KM 124/29-31 in lieu of L.C. No. 60 between Kalaikunda-Sardiha stations on KGP-TATA Section for improvement of road connectivity by Pushing Method. (With the help of Relieving Girder)"
  5. Sheet 4: G. A. Plan, Section and Sequence of Jacking: BR/MISC/28526/21 sh-4  
"Proposed R. C.C. Box Bridge (2.00mx2.00m) for extg. Up, Dn & 3<sup>rd</sup> Line beside the Existing Br. No. 50 (2x0.914,x1.65m FT) to be closed at KM 337/11-13 (337.434km) between JNK-TABU Station on RKSX-GX Branch Line Section in CKP Division. ( By Box Pushing Method)"
4. Indian Railways Unified Standard Schedule of Rates, 2010
5. TB/06/2019
6. Tender no. Engg/E-DRM ENGG-Adra-177-19/TB/87/19/0125250000
7. Tender no. CKP-SOUTH-19-20-57
8. AL No. WA/S/MGR/21/12-13 dtd 26.03.2013
9. Sources for content of presentation:
  1. Level Crossing Scenario of Indian Railways, International Railway Safety Conference, 2012, Sandeep Jain, Alok Kumar
  2. Ser.indianrailways.gov.in "Description of Level Crossings"
  3. Accidental Deaths & Suicides in India 2020, National Crime Records Bureau Ministry of Home Affairs
  4. Indian Railways Vision 2020, Government of India Ministry of Railways, December 2009
  5. Indian Railway Permanent Way Manual, Chapter IX, para 925
  6. Indian Road Congress 6-Lane manual 2013 (SP 87)
  7. Loksabha Unanswered Question No. 3430, answered on 10.12.2009 by Minister of State in Ministry of Railways, Shri K. H. Muniyappa
  8. Rajya Sabha response of Minister of State for Railways, Shri Manoj Sinha to question related to Construction of Railway ROB/RUB on Dec 5, 2015
  9. 4-Years Achievement Booklet "Vibrant Railways Strengthening Bengal" by Indian Railways for 2014-2018
  10. Railway Board Letter number 2006/CE-I/AC/1(Safety)Pt. dated 07.12.2009
  11. Tender Notice No. 13/CAO/C/SC/2016, dated 29.03.2016-Item-12, Page 18
  12. Railway Board Letter number 2017/CE-IV/RUB/88 dated 24.09.2019 (Instrn. No. 28/2019)

# ACKNOWLEDGEMENT

My heartfelt gratitude towards



Sri Sanjit Pal Sir, Dy. CE/Design(Bridge)/GRC,  
Sri Pulakesh Paul, SSE/DDE/GRC,  
Sri Ashutosh Jyoti, SSE/DDE/GRC and  
Sri Kumar Ravi Ranjan, SSE/DDE/GRC  
for their kind guidance and patience.





THANK YOU