



IMPLEMENTATION OF QUALITY PROCESS FOR BANGALORE METRO

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BMRCL

A BRIEF ON THE PROJECT – PHASE 2, 2A, 2B

Sl. No.	Phase	Length (Kms)		No. of stations
		Elevated	Under ground	
1	1	33.9	8.4	41
2	2	76.9 (13.8 completed)	12	62
3	2A	18.5	Nil	13
4	2B	37.3	Nil	17
	Total	187		133



VIADUCT

Phase 2

➤ Segment Construction

Standard Span length:

- 31.0 m
- 28.0 m
- 25.0 m
- 22.0 m

➤ I - GIRDERS - of required length

➤ Composite steel girder



Phase 2A, 2B

- U - Girders
- I - Girders - of required length
- Composite steel girder



FOUNDATIONS :

➤ PILE FOUNDATIONS - IS 2911 (PART 1)

1. Friction Piles
2. End Bearing Piles

➤ OPEN FOUNDATIONS

BRIEF CHARACTERISTICS OF PILES IN PROJECT

DIA OF PILES	: 600 mm, 1000 mm, 1200 mm, 1500mm
GRADE OF CONCRETE	: M 35
CEMENT	: PSC or (OPC 53 + GGBS)
POURING	: TREMMIE METHOD
BORE STABILIZER	: POLYMER



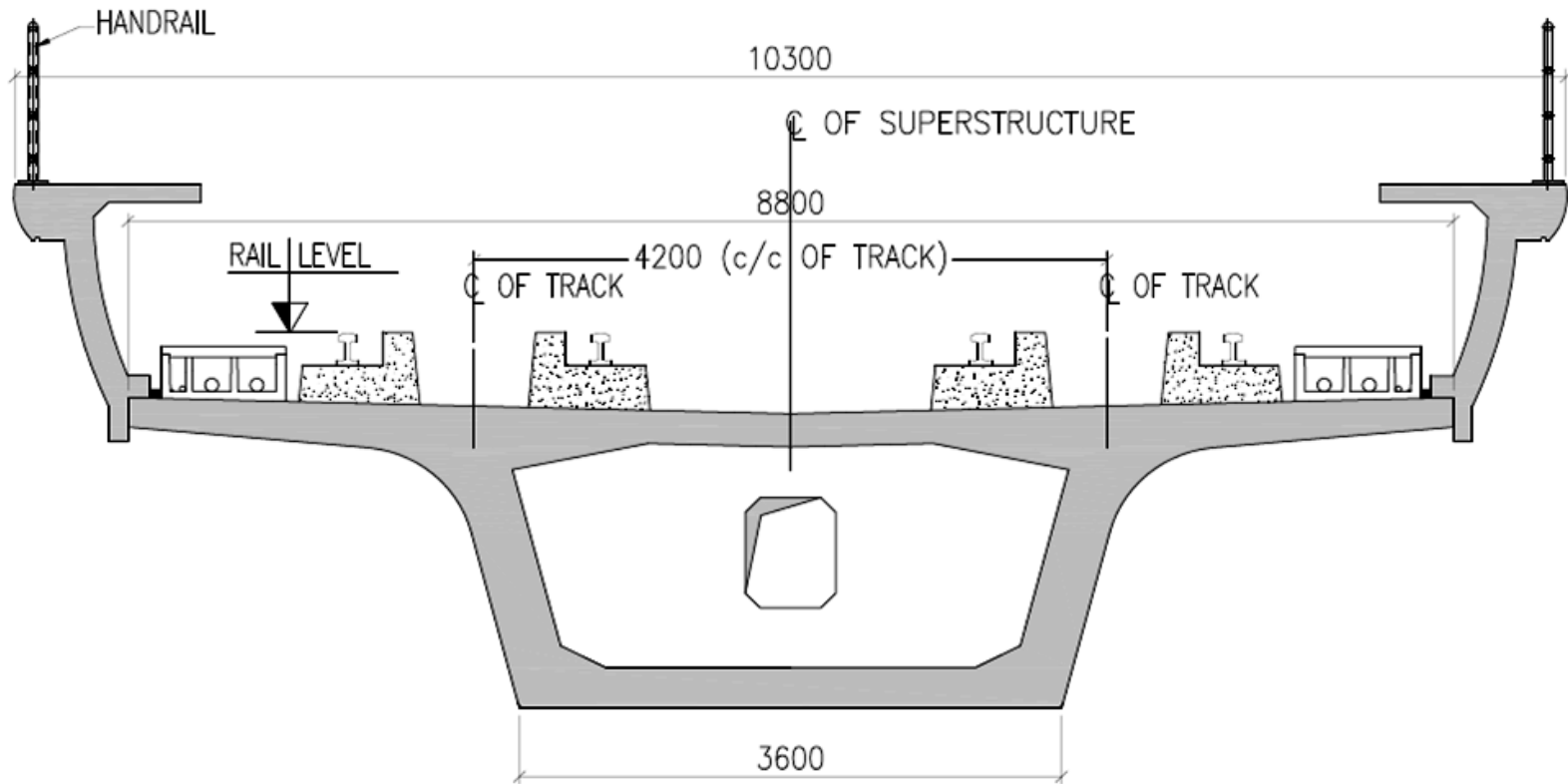
TYPICAL PILE CAP



NORMAL PIER & ECCENTRIC PIER



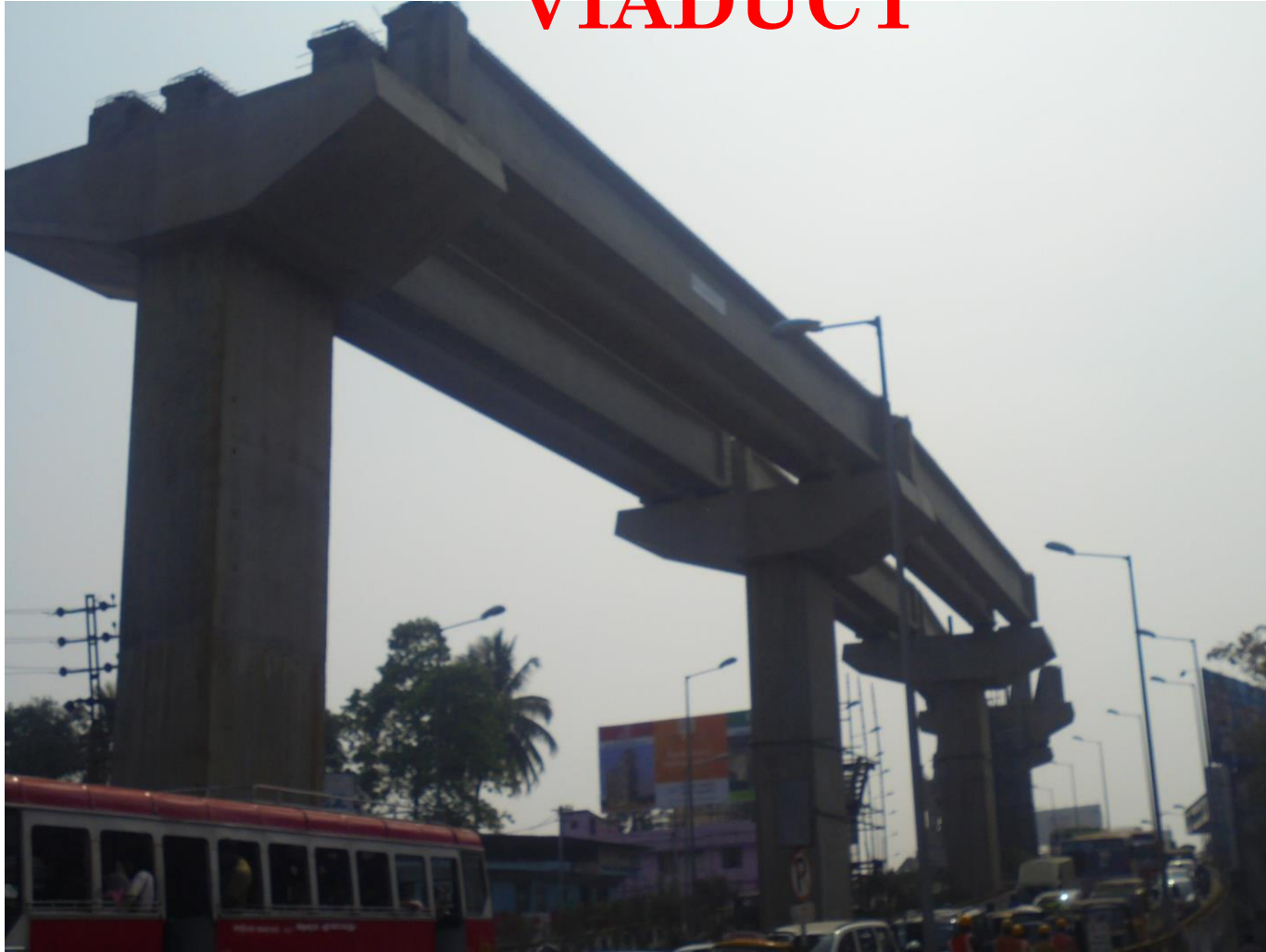
TYPICAL C/s OF VIA DUCT BOX GIRDER



CROSS SECTION
(SCALE 1:75)



LAUNCHED I-GIRDER IN VIADUCT



CASTING OF U GIRDER- REINFORCEMNT



U-GIRDERS PLACED IN POSITION



UNDERGROUND

- CONSTRUCTION OF TUNNELS
 - TUNNELLING USING TBM
 - TUNNELLING BY NATM
 - CUT AND COVER TUNNEL



- CONSTRUCTION OF STATIONS
 - TOP-DOWN METHOD
 - BOTTOM –UP METHOD



UNDERGROUND STATIONS

TYPE OF STATION

- On road
- Off road
- Partly on road and partly off road

STATION PROFILE

- Linear
- Curvilinear

LEVELS

- Street level
- Concourse level
- Platform level

SIZE (INNER DIMENSIONS)

- Length of the station box – 228m approximately
- Width of the station box – about 19m
- Width of the station box at ends – about 22m



UNDERGROUND STATION – TYPICAL C/S



UNDERGROUND STATIONS: PLATFORM LEVEL

- Island Platform
- 135m long and 11m wide (may vary according to the Track centerline distance)
- Track and platform separated by Platform Screen Door
- Ventilation – Mechanical Equipment Room (AHU)
- System – Signaling Equipment Room, Telecom Closet , PSD-LCP Etc.,
- MVSGR
- Waste water , Sewage Water Pump & Sump Room
- Emergency Exits
- Steps to Track level from platform Level at each end of platform
- Firemen staircase and Refuge Room



WHAT IS AN ISLAND PLATFORM?

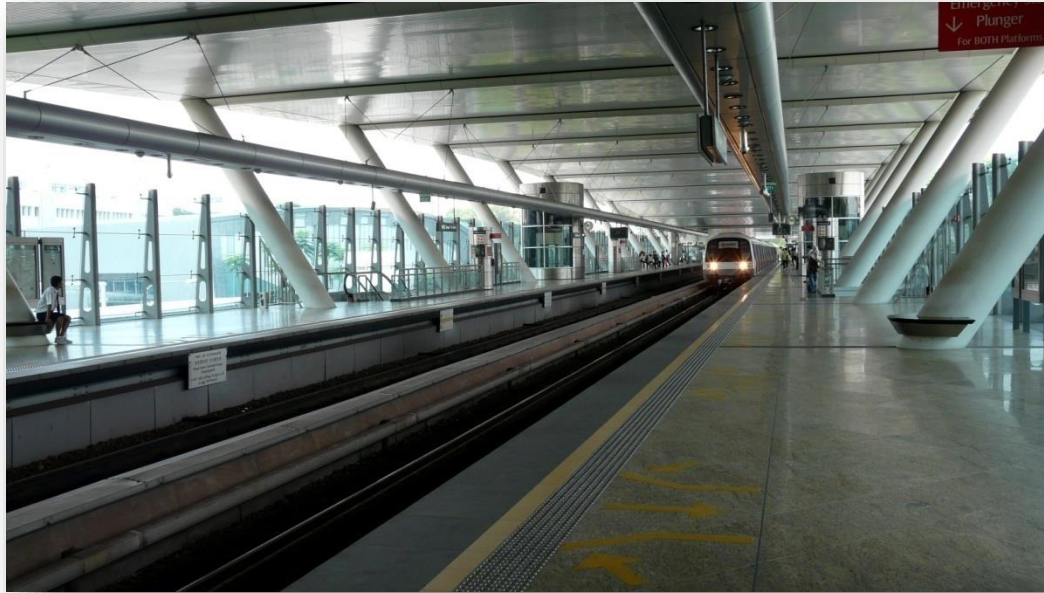


- ⊕ Single platform lies between two tracks, serving both of them
- ⊕ Usually, the two tracks run in opposite directions

ISLAND PLATFORM

- Generally have a lower construction cost and require less space than side platform
- Allow facilities such as escalators, elevators, shops, toilets and waiting rooms to be shared between both tracks rather than being duplicated
- Passengers tend to use trains in one direction in the morning and the other direction in the evening. With two side platforms, one platform becomes crowded while the other is deserted. An island platform prevents this as the same large platform is used for trains in both ways
- Allow passengers to use any station entrance and eliminate the need for some signage

WHAT IS A SIDE PLATFORM?



⊕ Has two individual platforms, one for each direction of travel

⊕ Track centres remain the same, and no space is lost for slewing the track to wider centres, as would be needed for an island platform



TYPES OF RETAINING WALLS

- Diaphragm wall system
- Secant pile walls



DIAPHRAGM WALL



A diaphragm wall is a reinforced concrete wall cast in a trench, the sides of which are supported prior to casting, by the hydrostatic pressure of slurry

- Requires less joints than a piled wall
- Water bar can be incorporated
- Facilitates easy connection for slabs
- Box outs can be incorporated

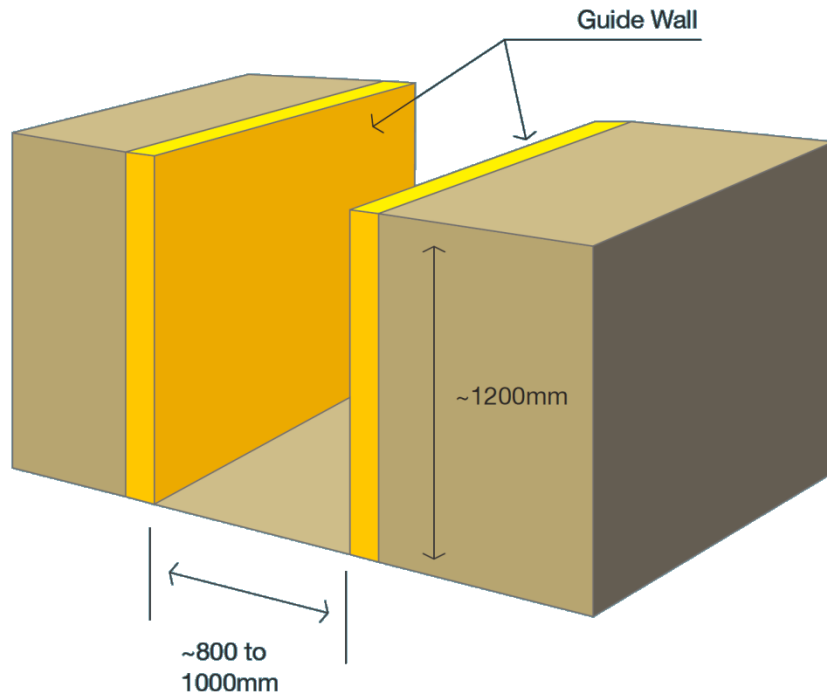


Diaphragm Wall system



CONSTRUCTION SEQUENCE OF D-WALL

01 . Construction of Guide Wall



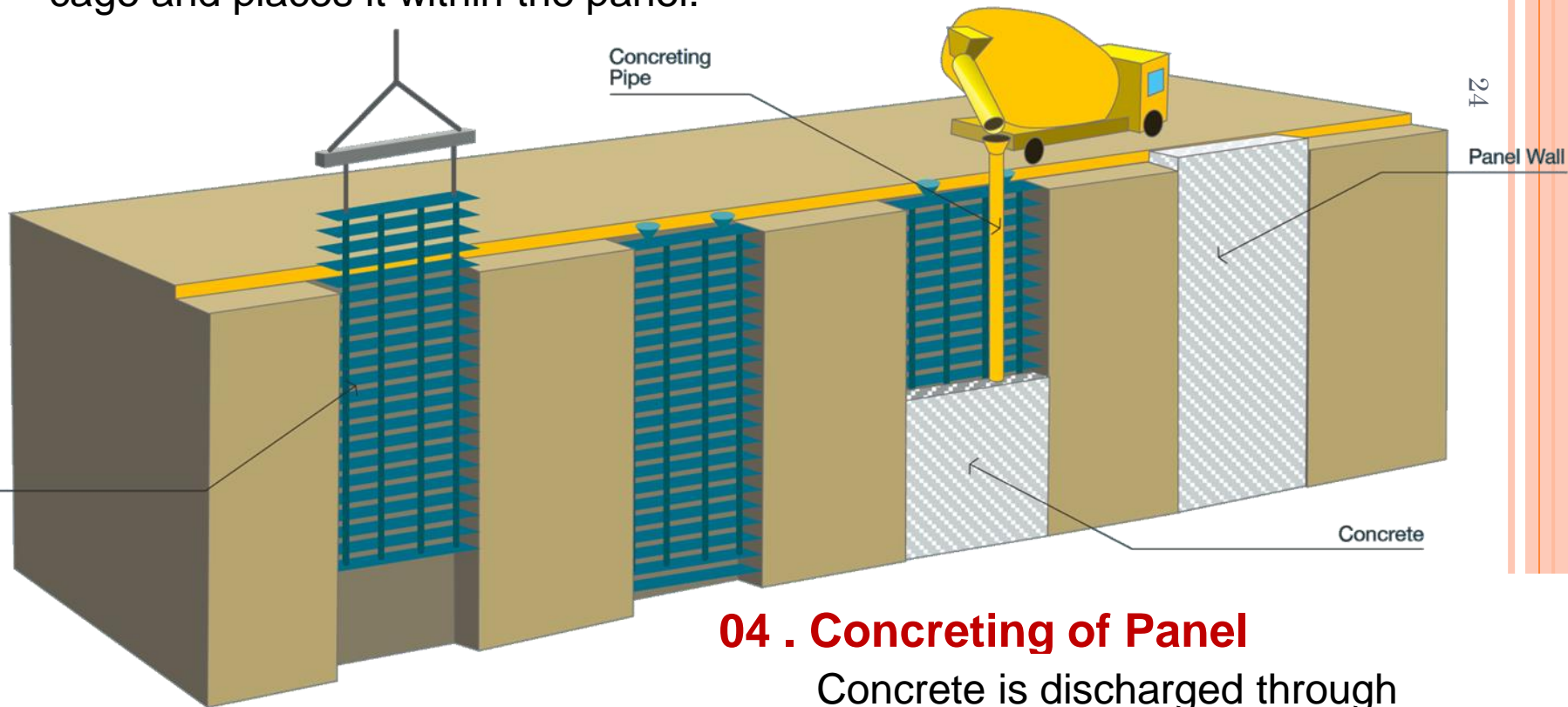
Functions of guide wall:

- To guide the grab during diaphragm wall excavation
- To support reinforcement, stop-ends and act as a platform for concreting operation
- To provide additional hydrostatic head for trench stabilisation
- To ensure position and verticality of diaphragm wall

CONSTRUCTION SEQUENCE OF D-WALL

03 . Installation of Rebar Cage

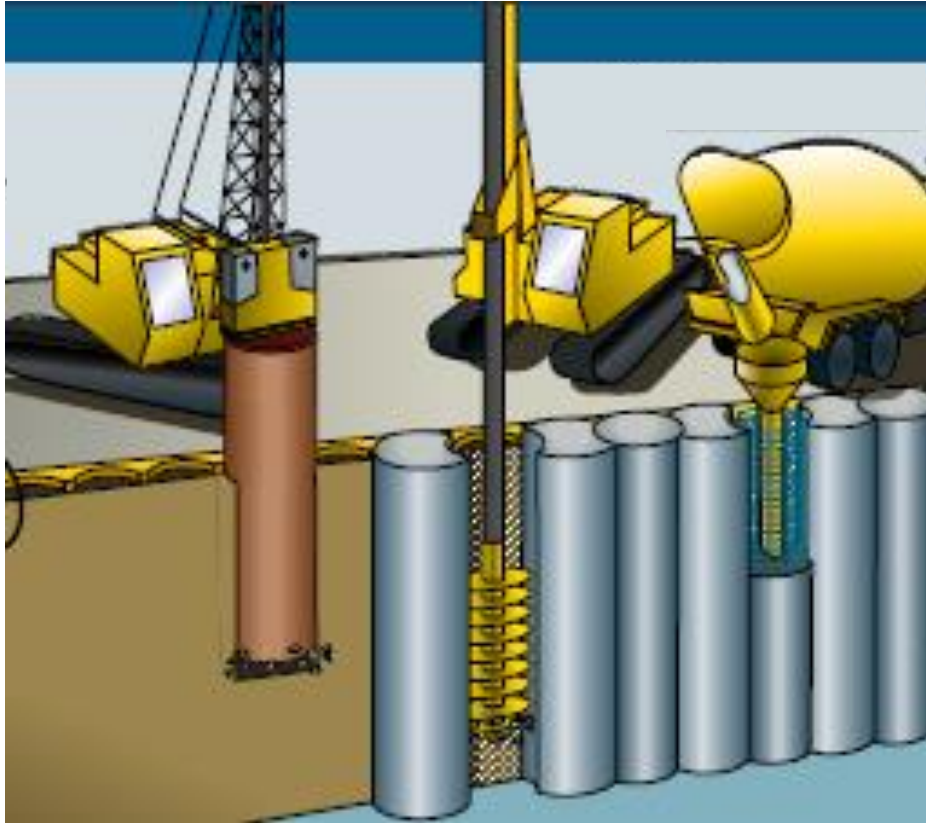
The crane lifts up the reinforcement-bar cage and places it within the panel.



04 . Concreting of Panel

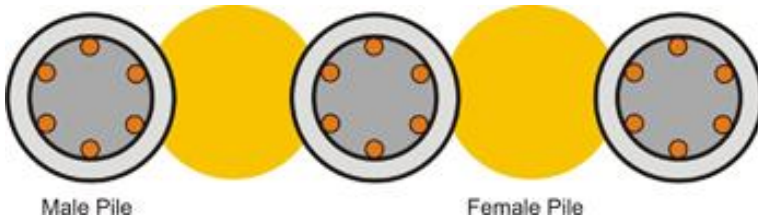
Concrete is discharged through tremie pipes to form the panel wall

SECANT PILE WALL

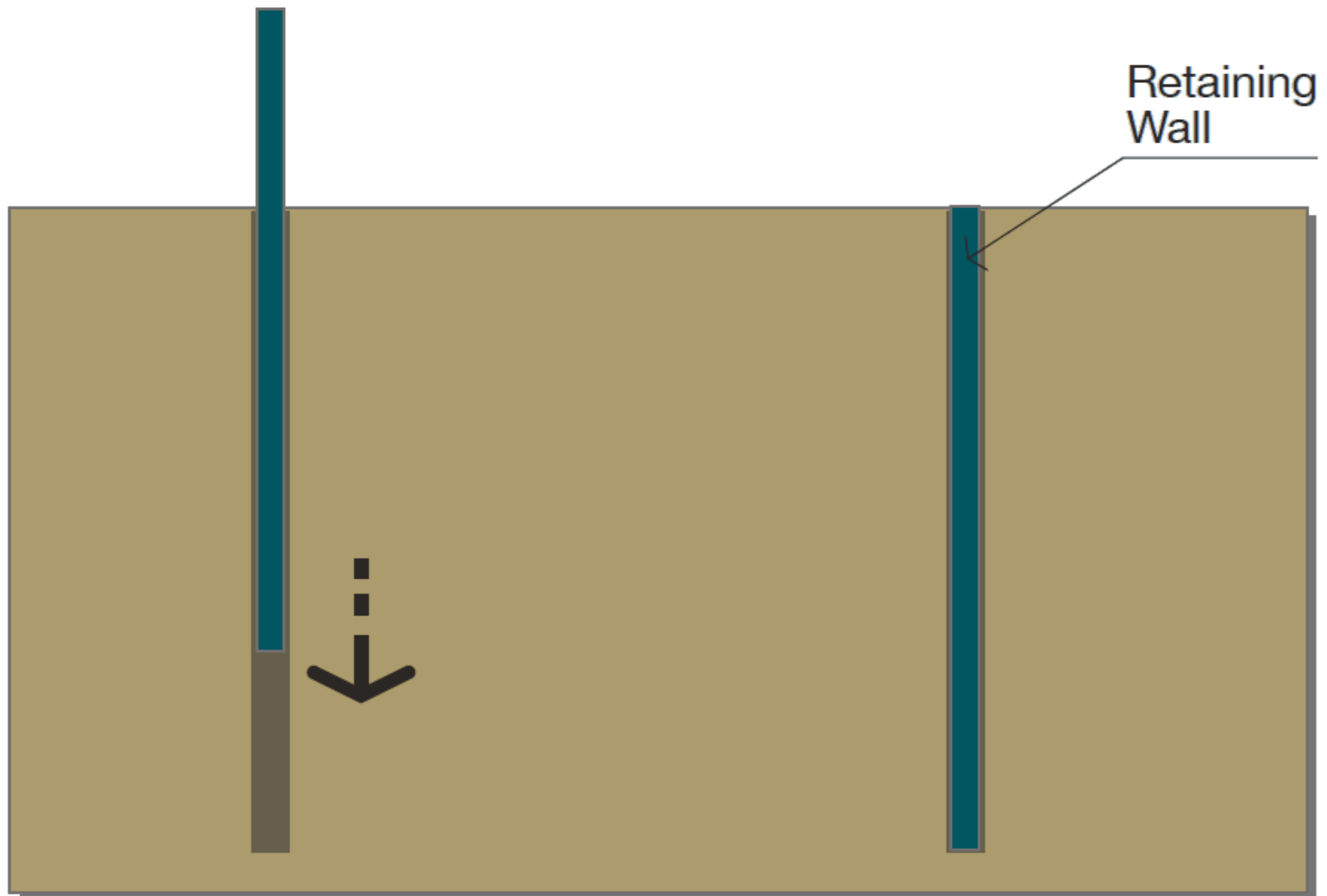


..... consists of a series of primary and secondary bored cast in situ piles casted alternatively. The secondary piles are installed by cutting a portion of the concrete from the adjacent primary piles on both sides forming a water tight wall

The end product provides a fully concreted face and can be an effective alternative to diaphragm



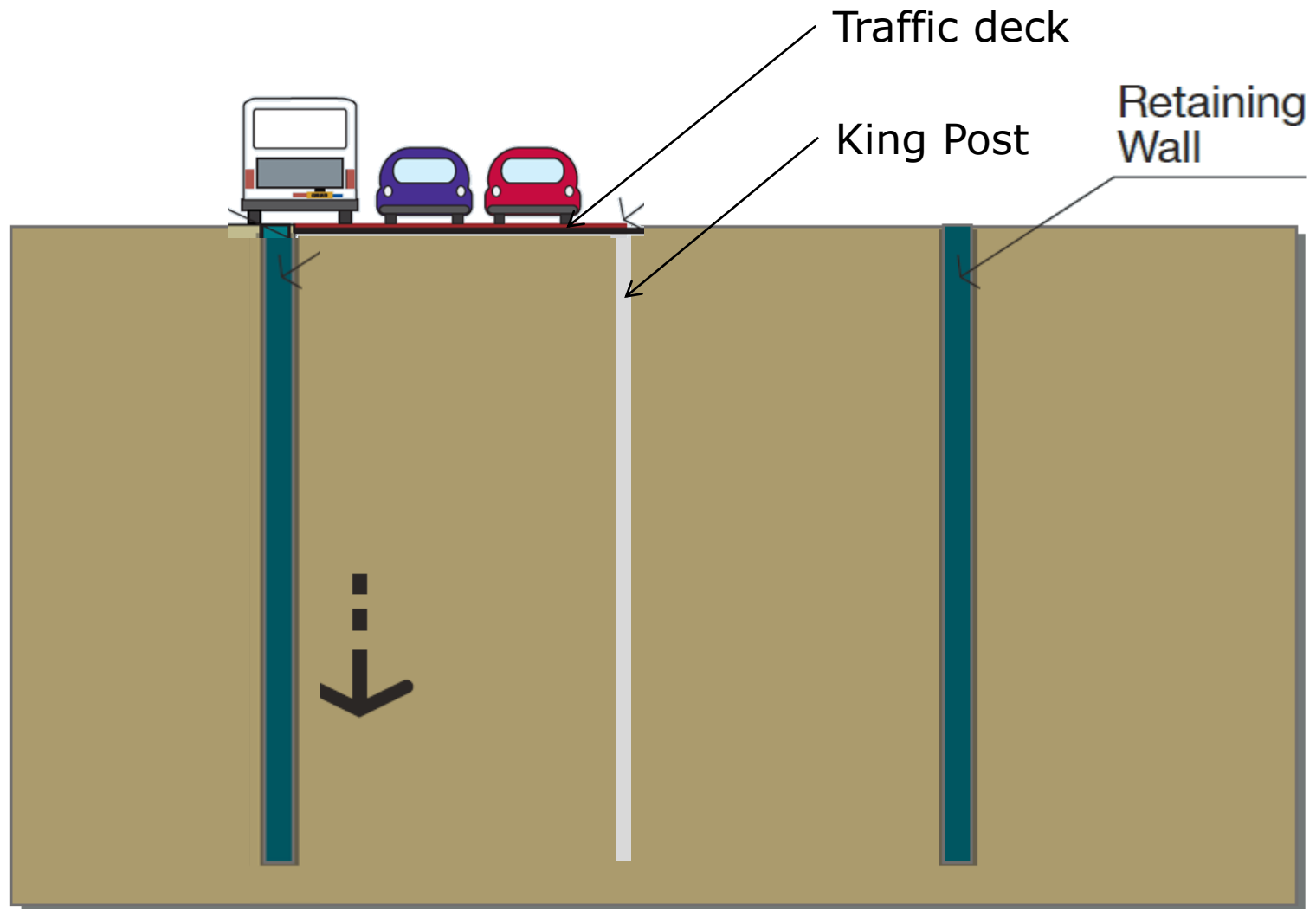
BOTTOM-UP CONSTRUCTION



Installation of retaining wall



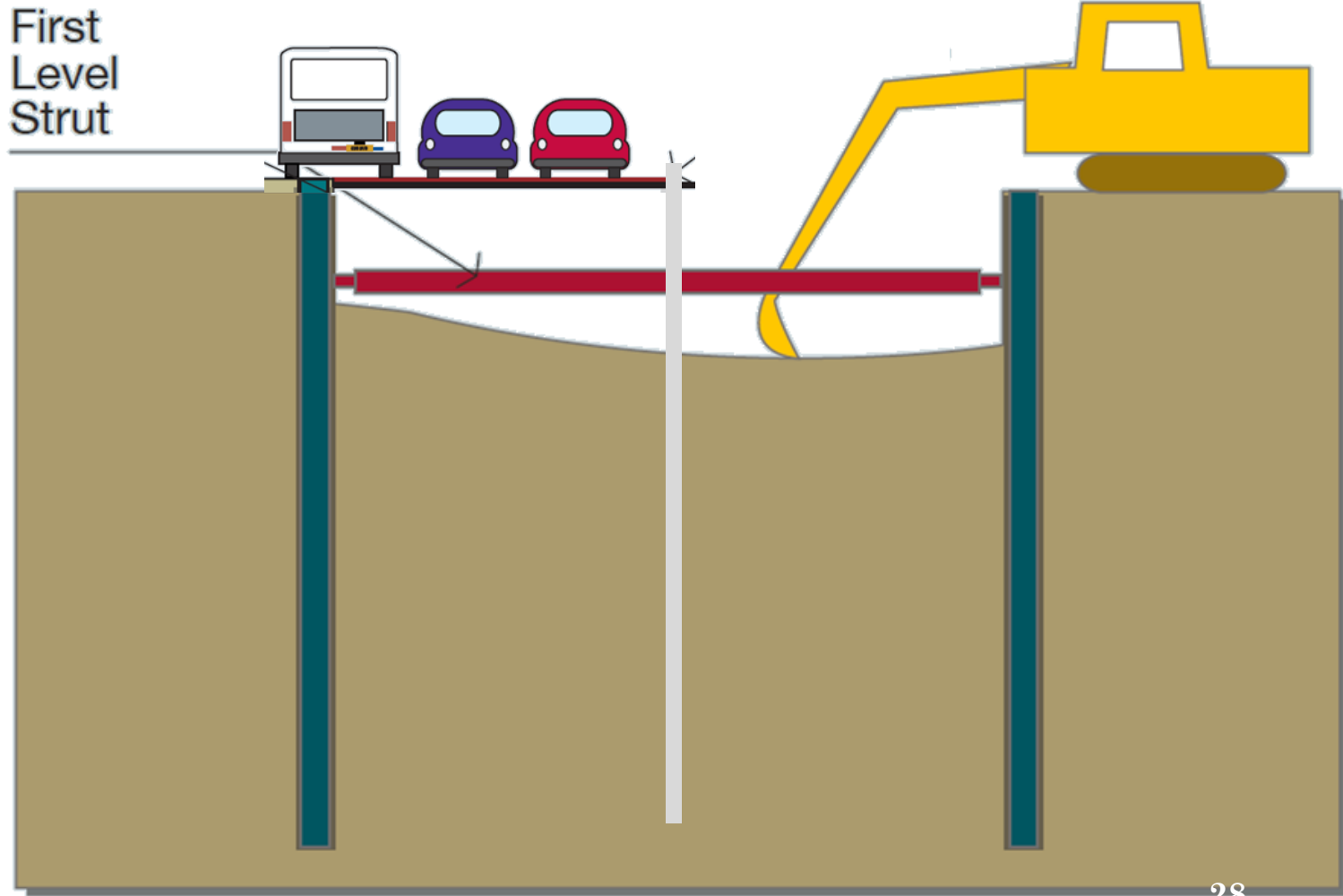
BOTTOM-UP CONSTRUCTION



Complete installation of retaining wall



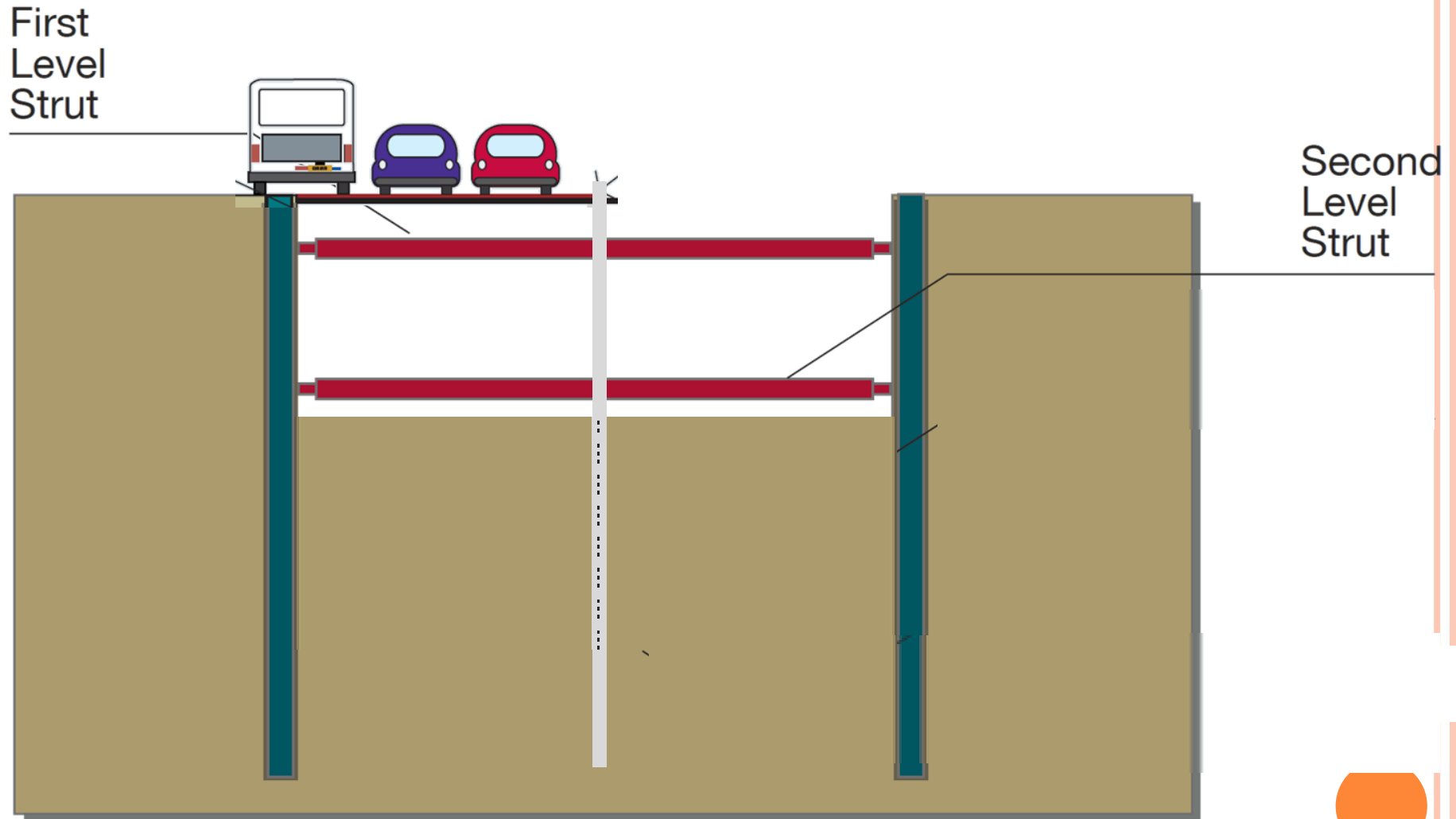
BOTTOM-UP CONSTRUCTION



Excavation from ground level & installation of 1st level strut

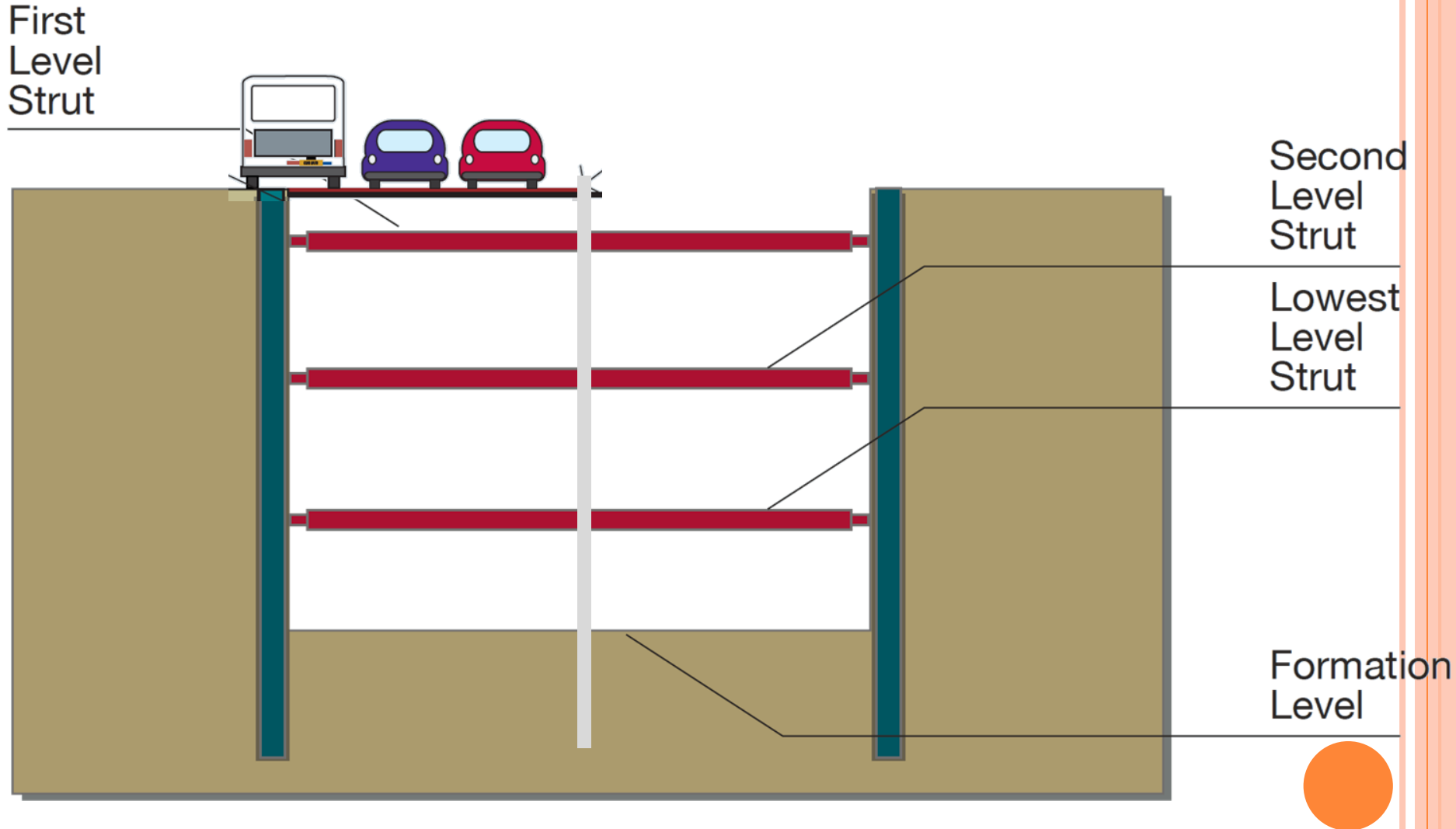


BOTTOM-UP CONSTRUCTION



Excavation continues & installation of 2nd level strut

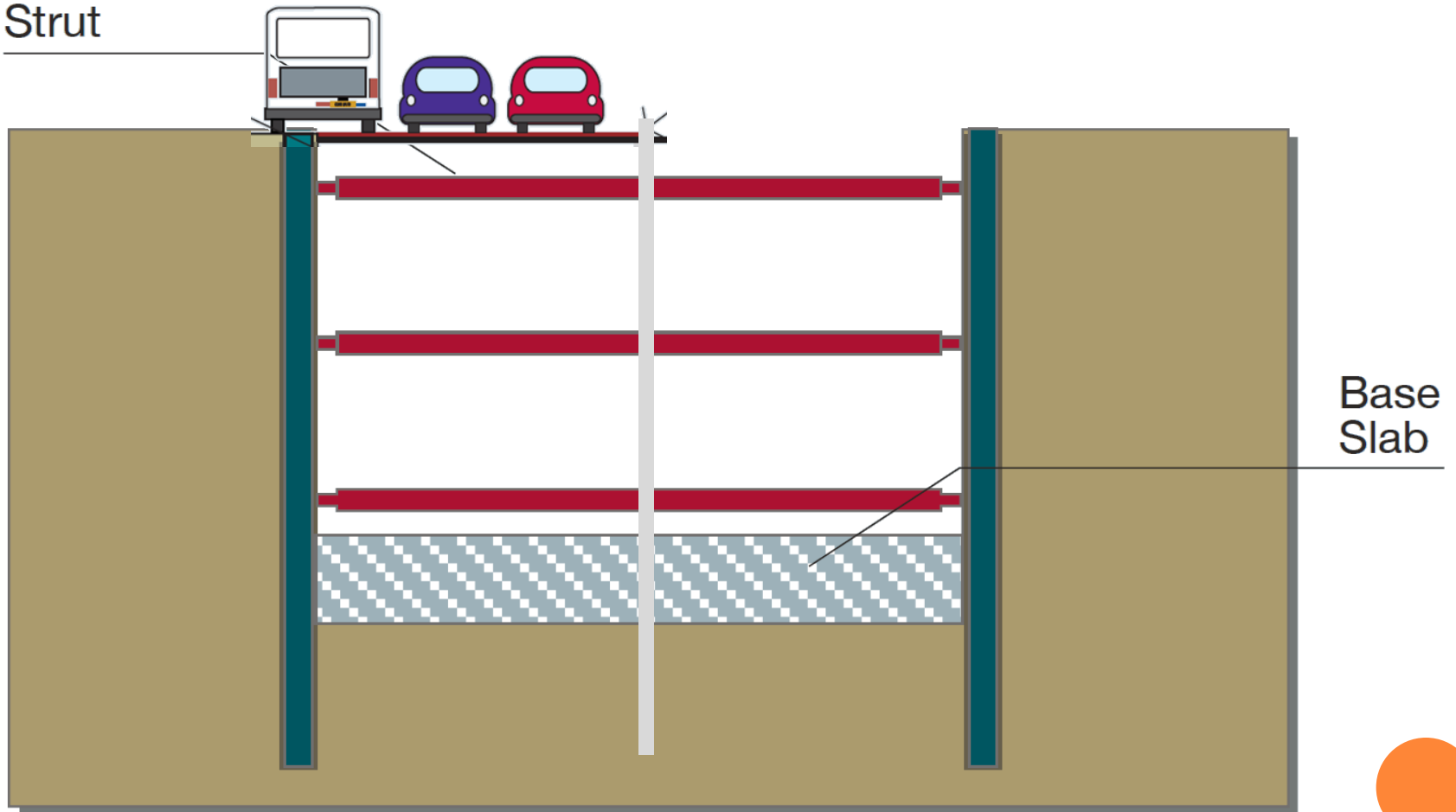
BOTTOM-UP CONSTRUCTION



Excavation continues to formation level with installation of struts

BOTTOM-UP CONSTRUCTION

First
Level
Strut

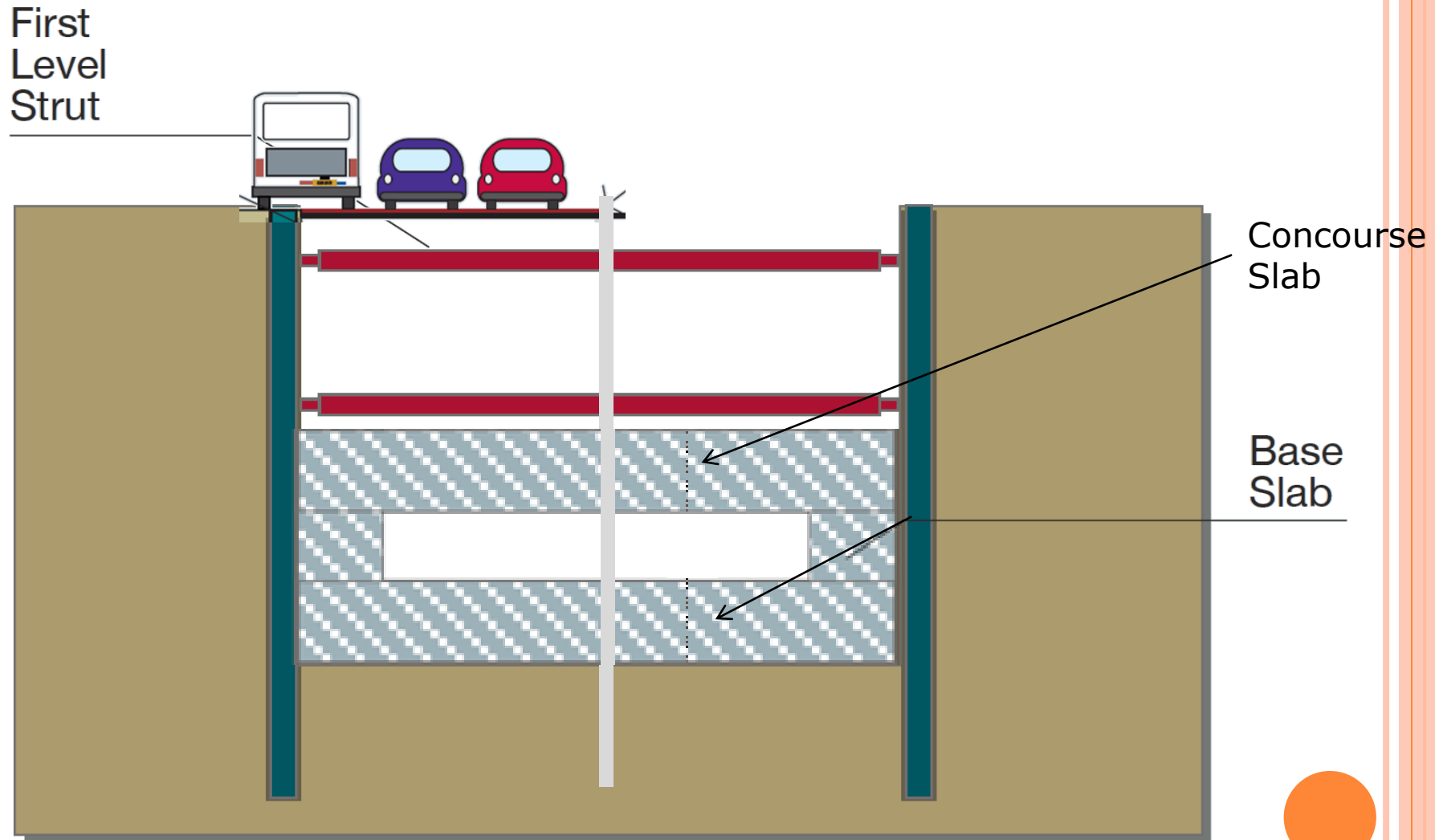


Base
Slab

Construction of base slab



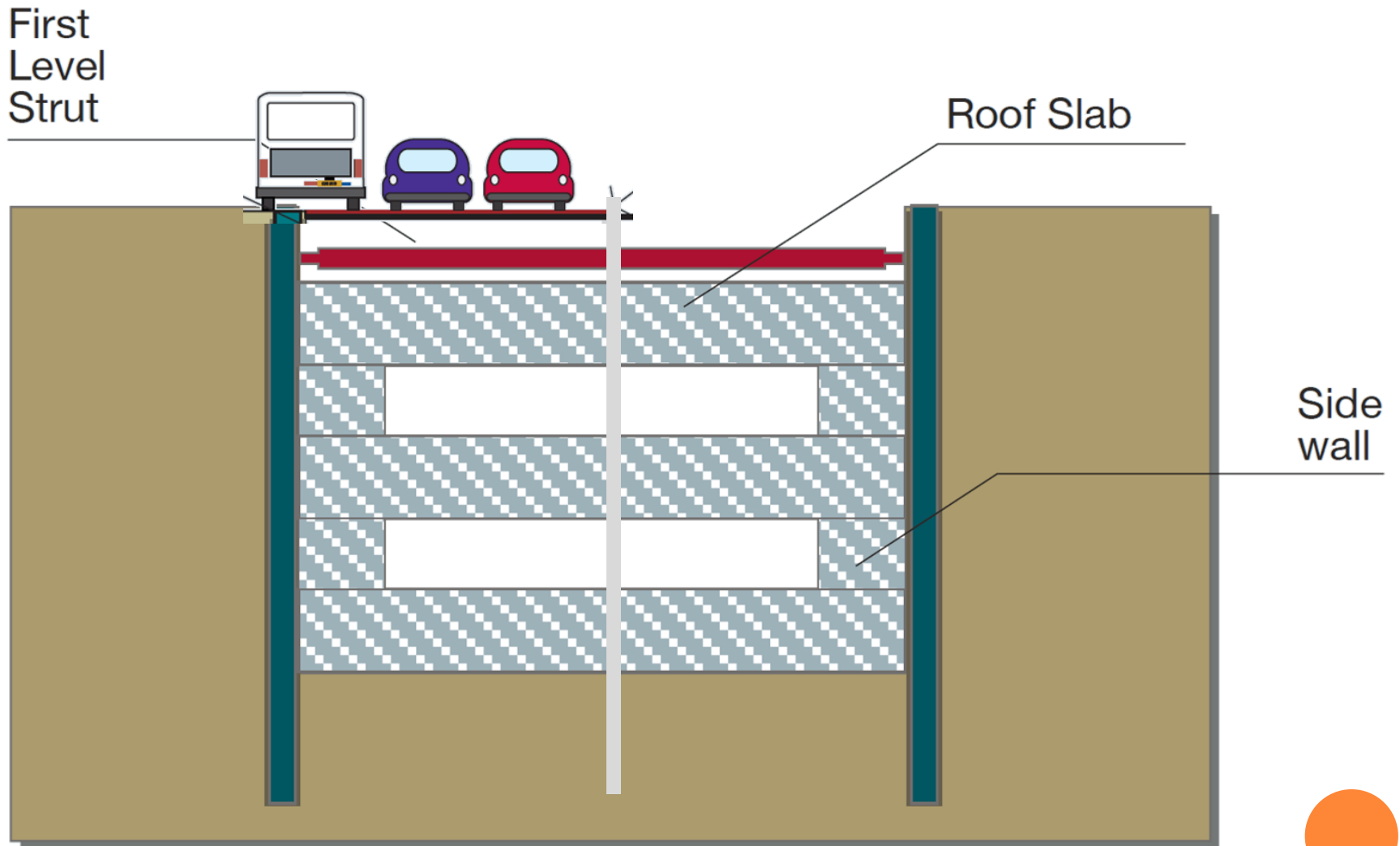
BOTTOM-UP CONSTRUCTION



Completion of walls/ columns & concourse slab



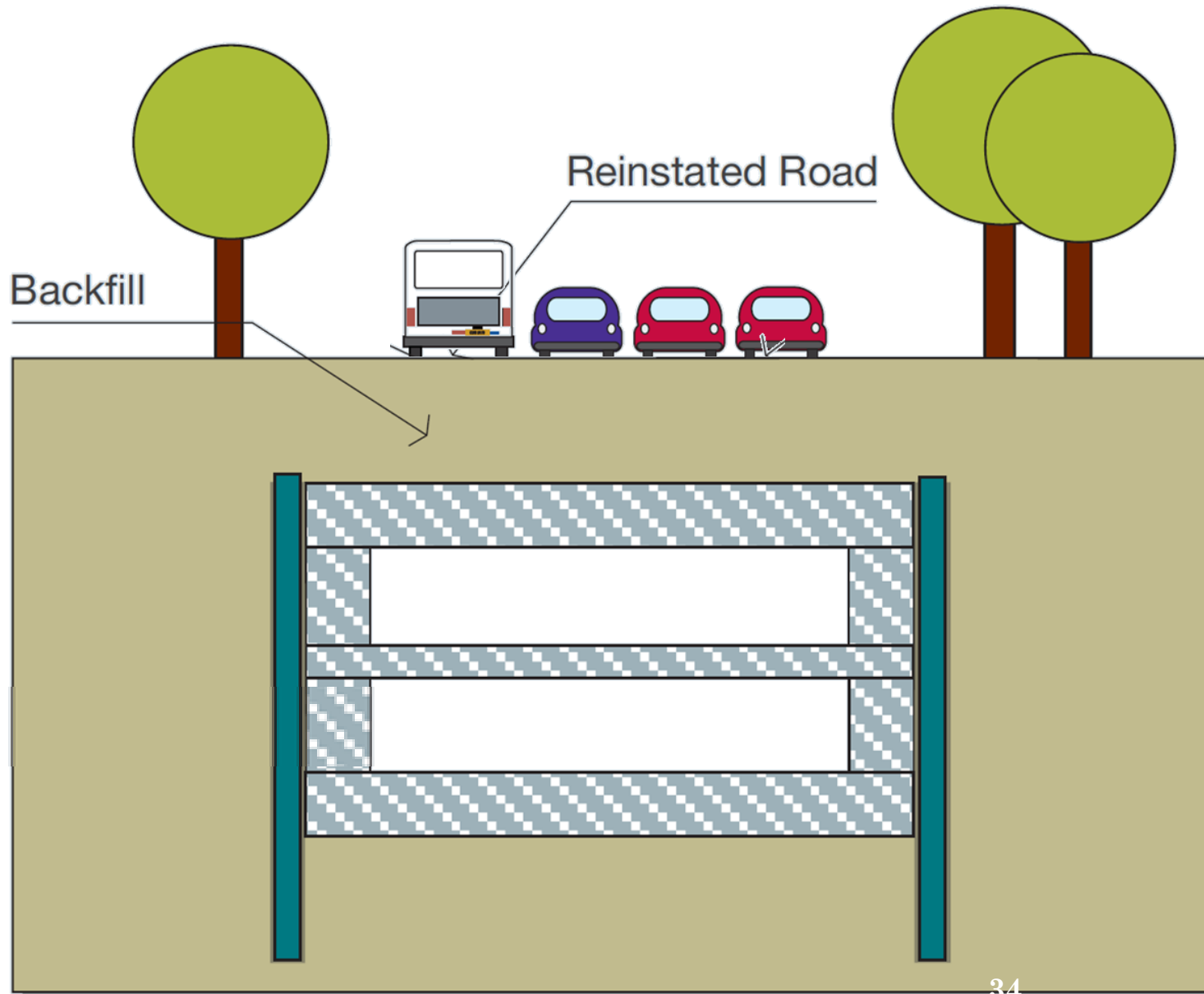
BOTTOM-UP CONSTRUCTION



Construction of walls/ columns & roof slab



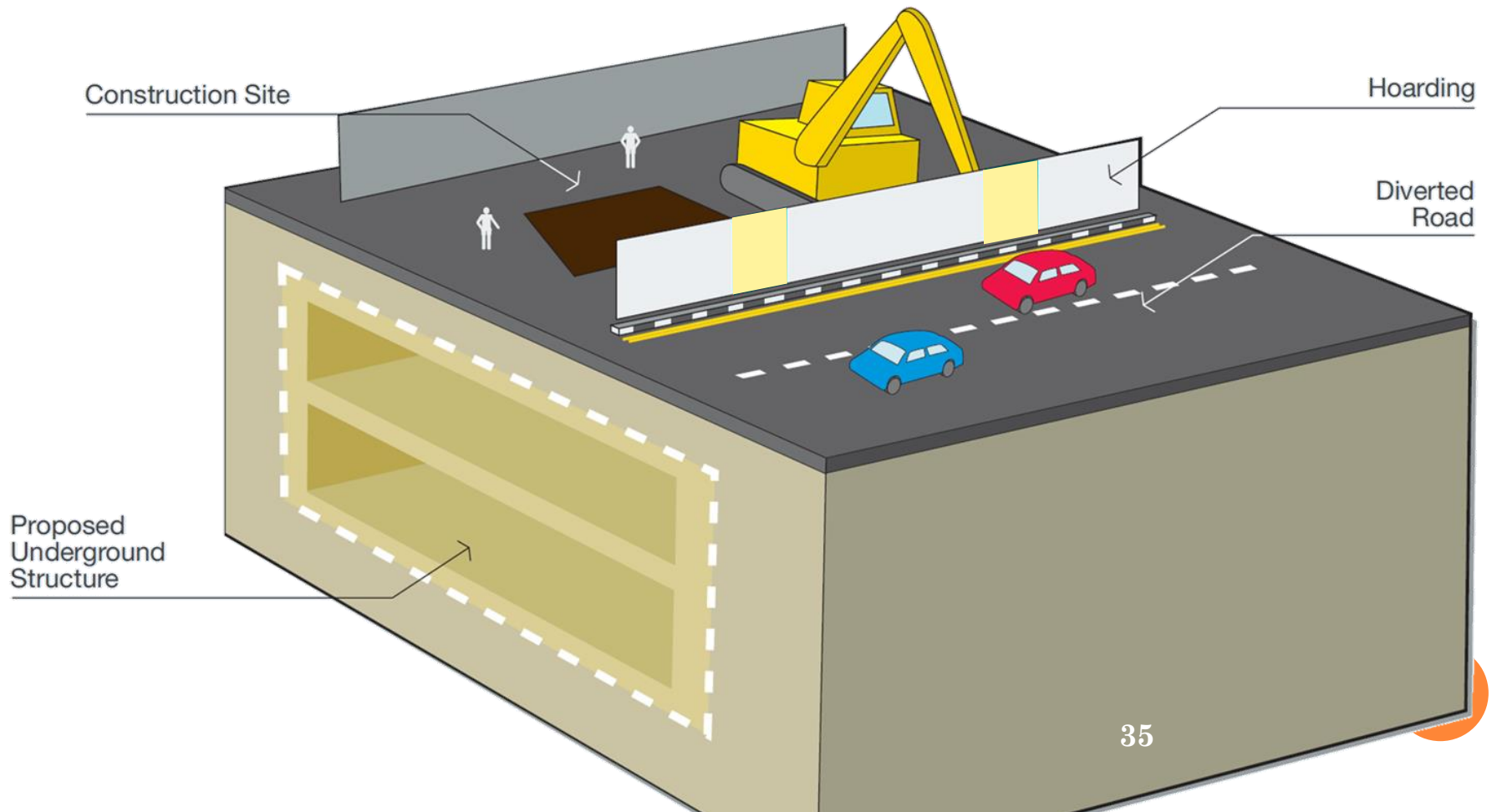
BOTTOM-UP CONSTRUCTION



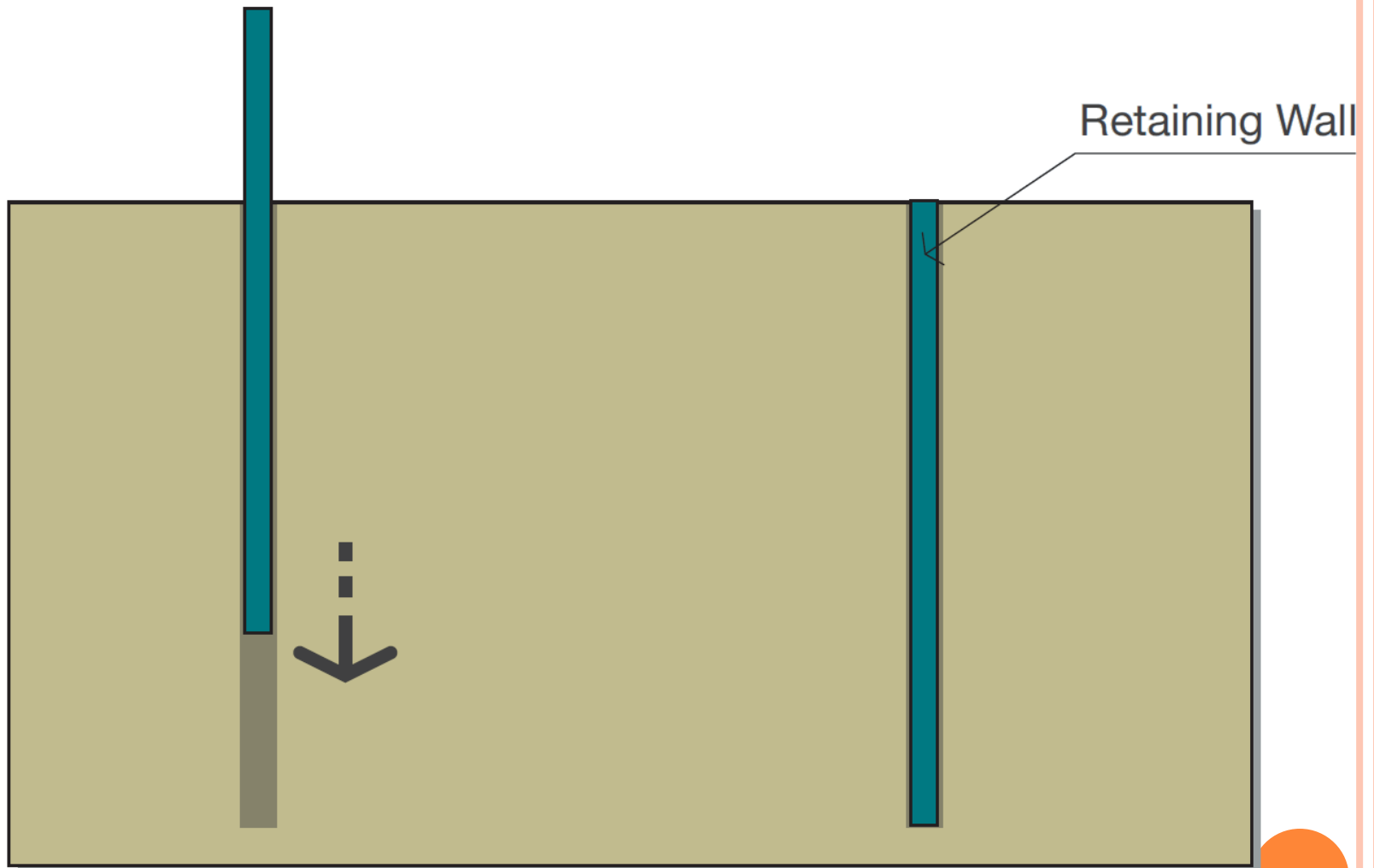
Removal of 1st level strut & reinstatement of ground



TOP-DOWN CONSTRUCTION

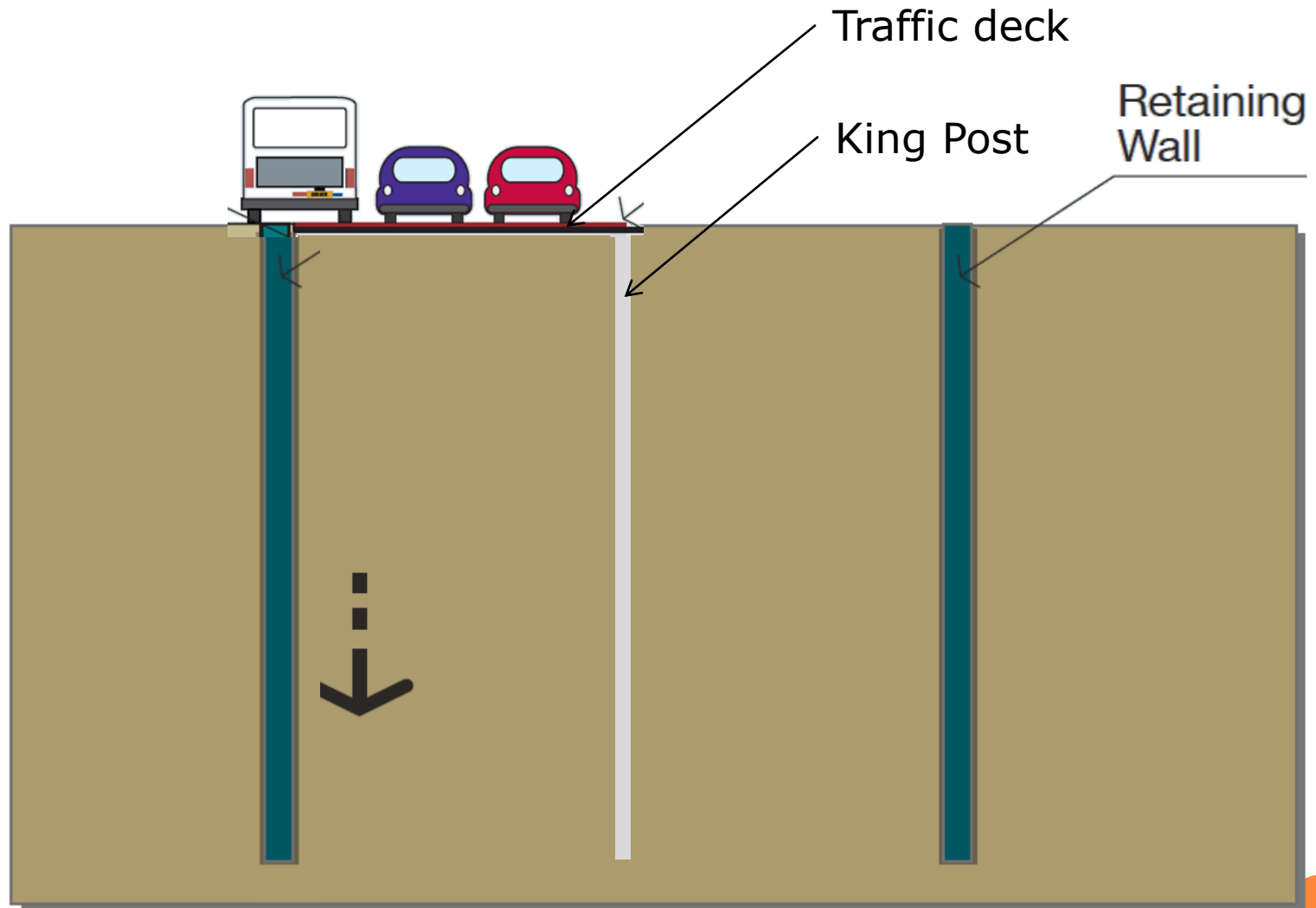


TOP-DOWN CONSTRUCTION



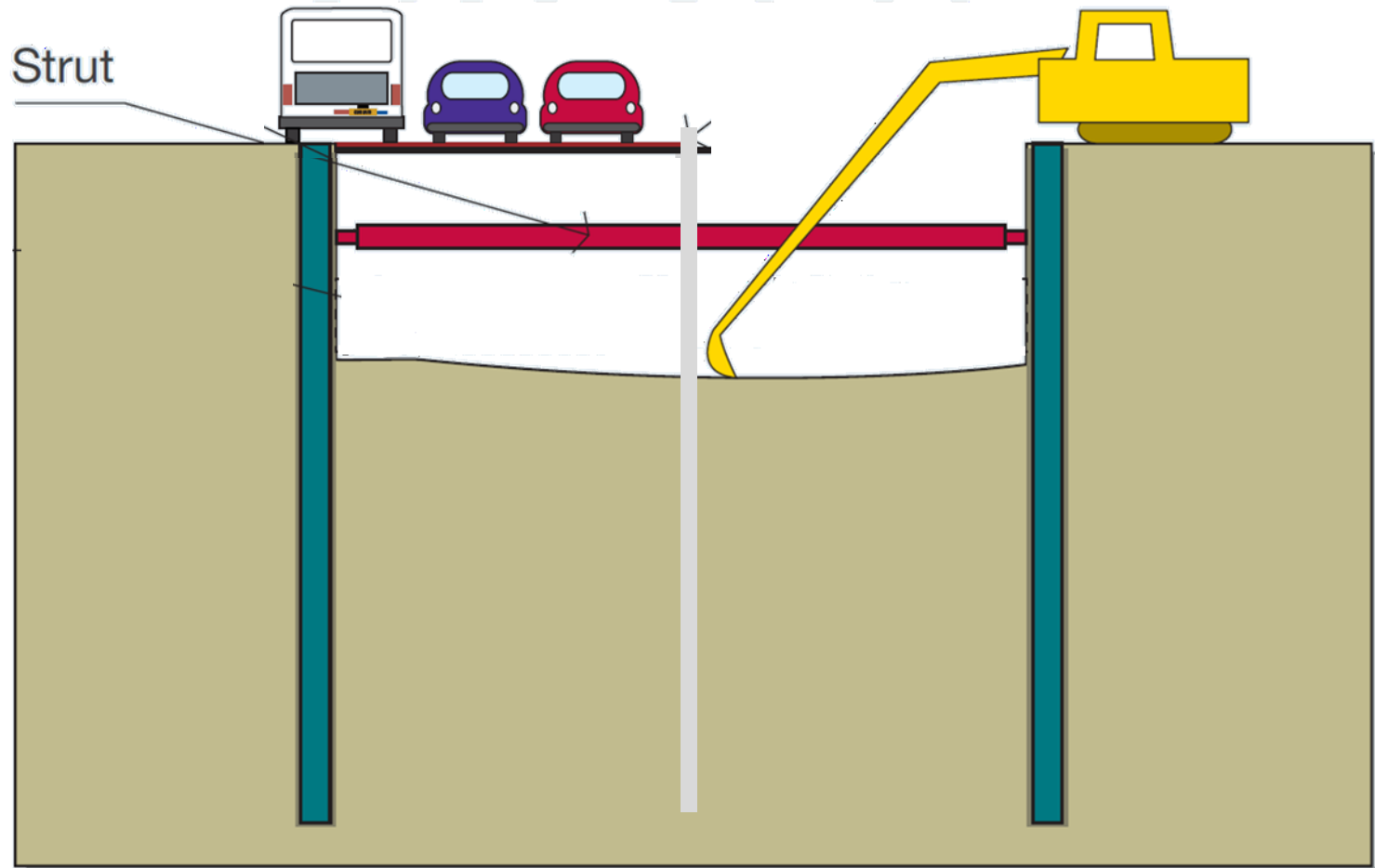
Installation of retaining wall

TOP-DOWN CONSTRUCTION



- Complete installation of king post
- Complete installation of traffic deck
- Complete installation of retaining wall

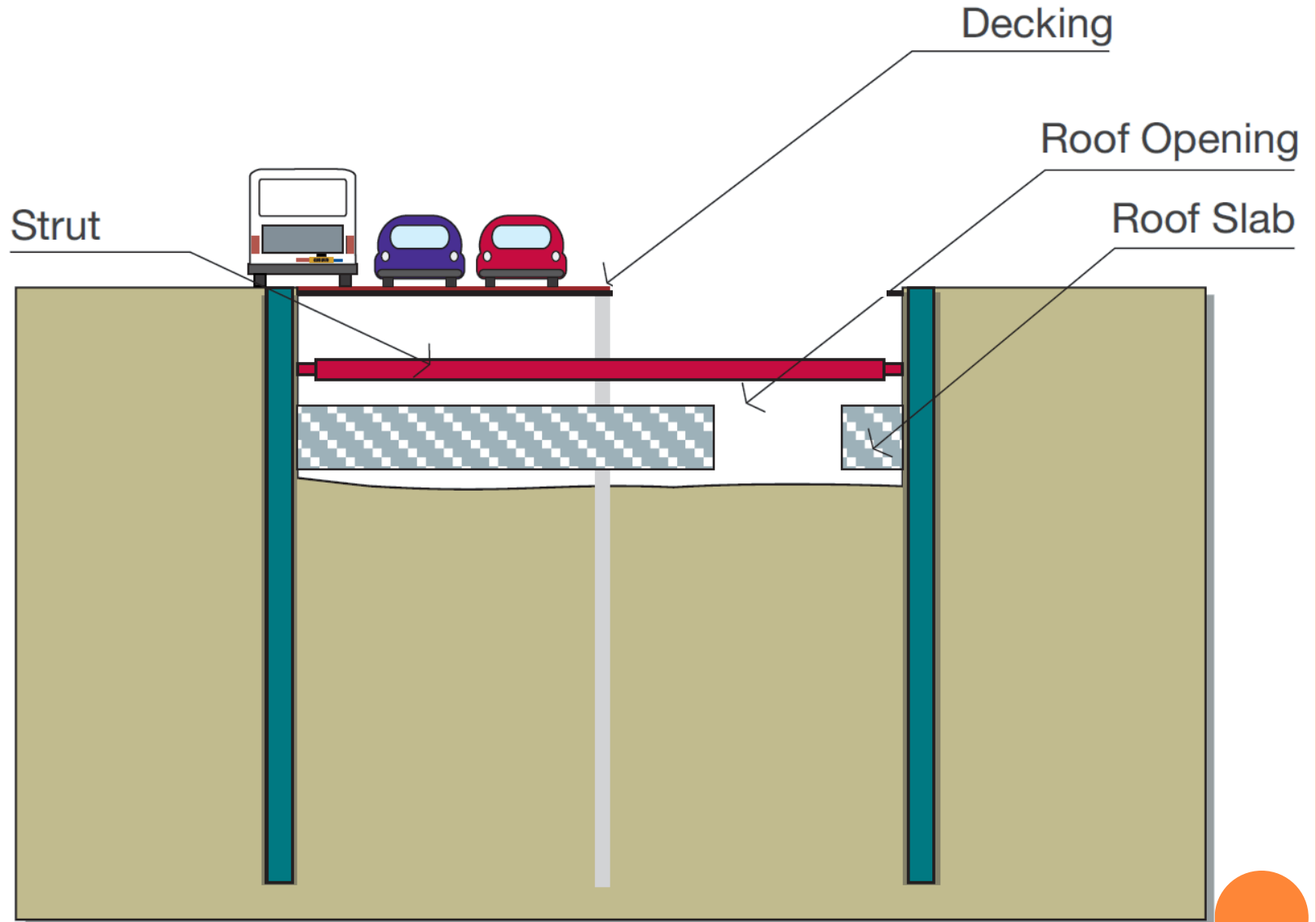
TOP-DOWN CONSTRUCTION



Installation of 1st level strut & excavation to just below the soffit of roof slab



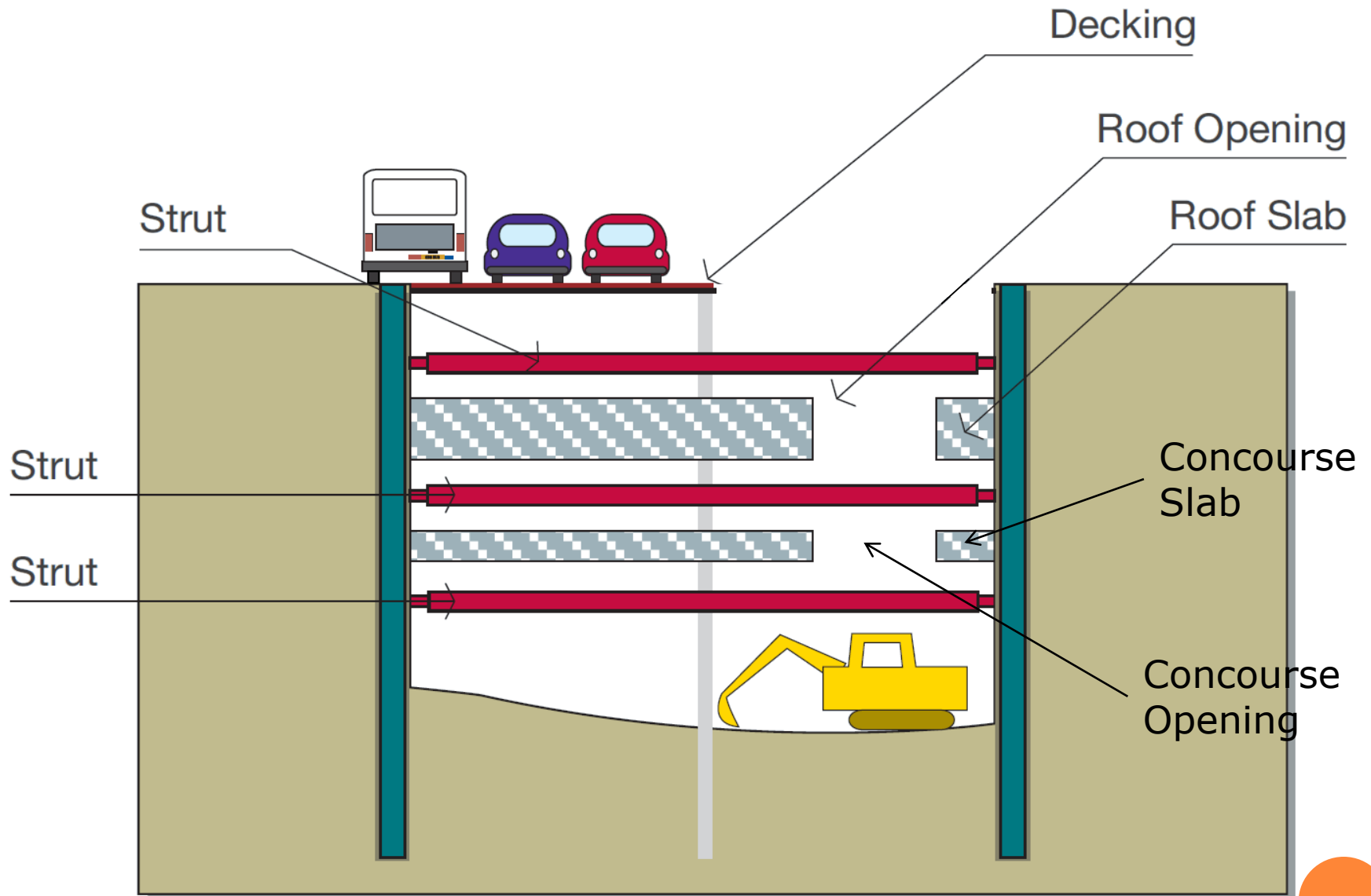
TOP-DOWN CONSTRUCTION



Construction of roof slab with access openings



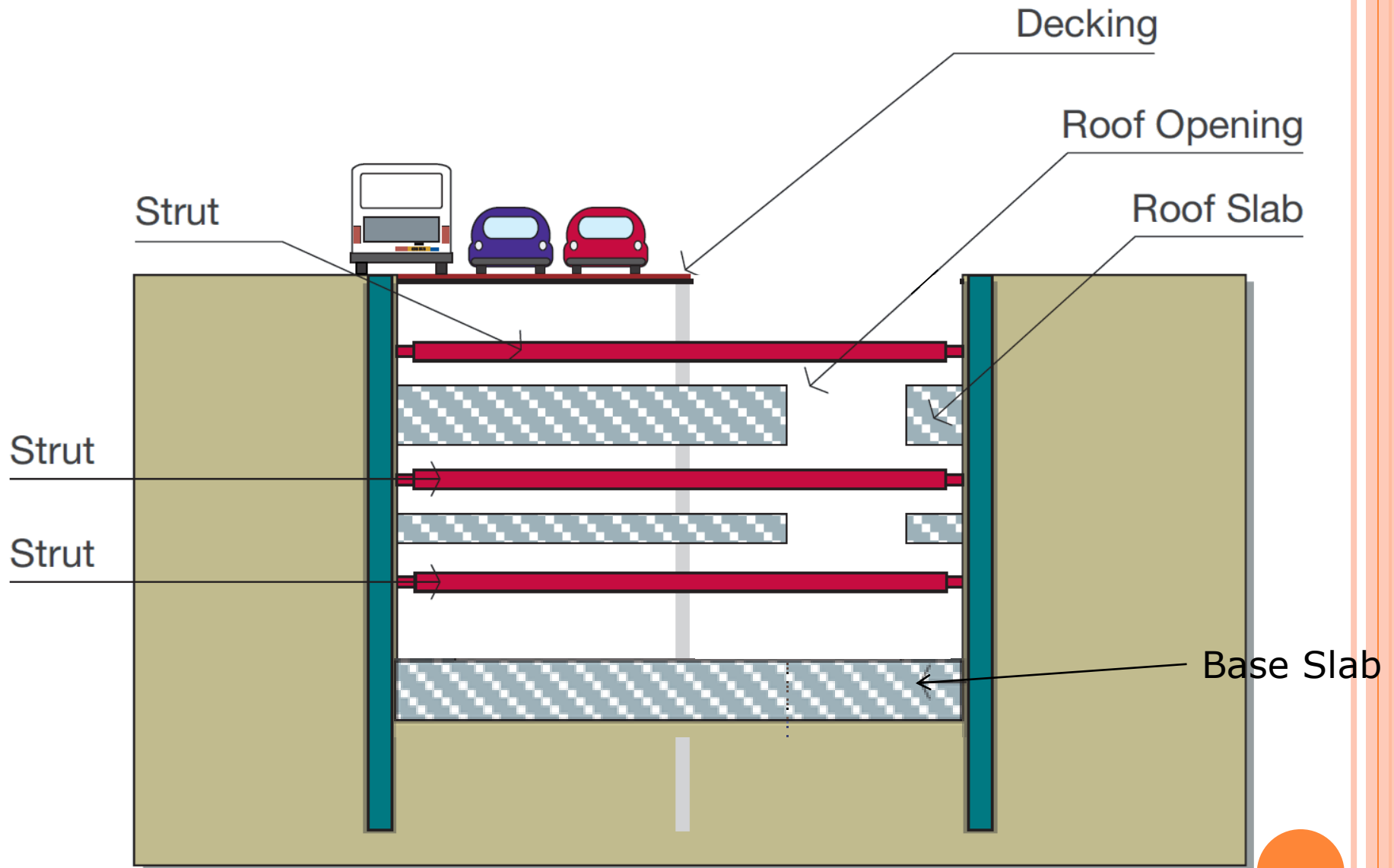
TOP-DOWN CONSTRUCTION



Construction of concourse slab with access openings & excavation proceeds further down to formation level



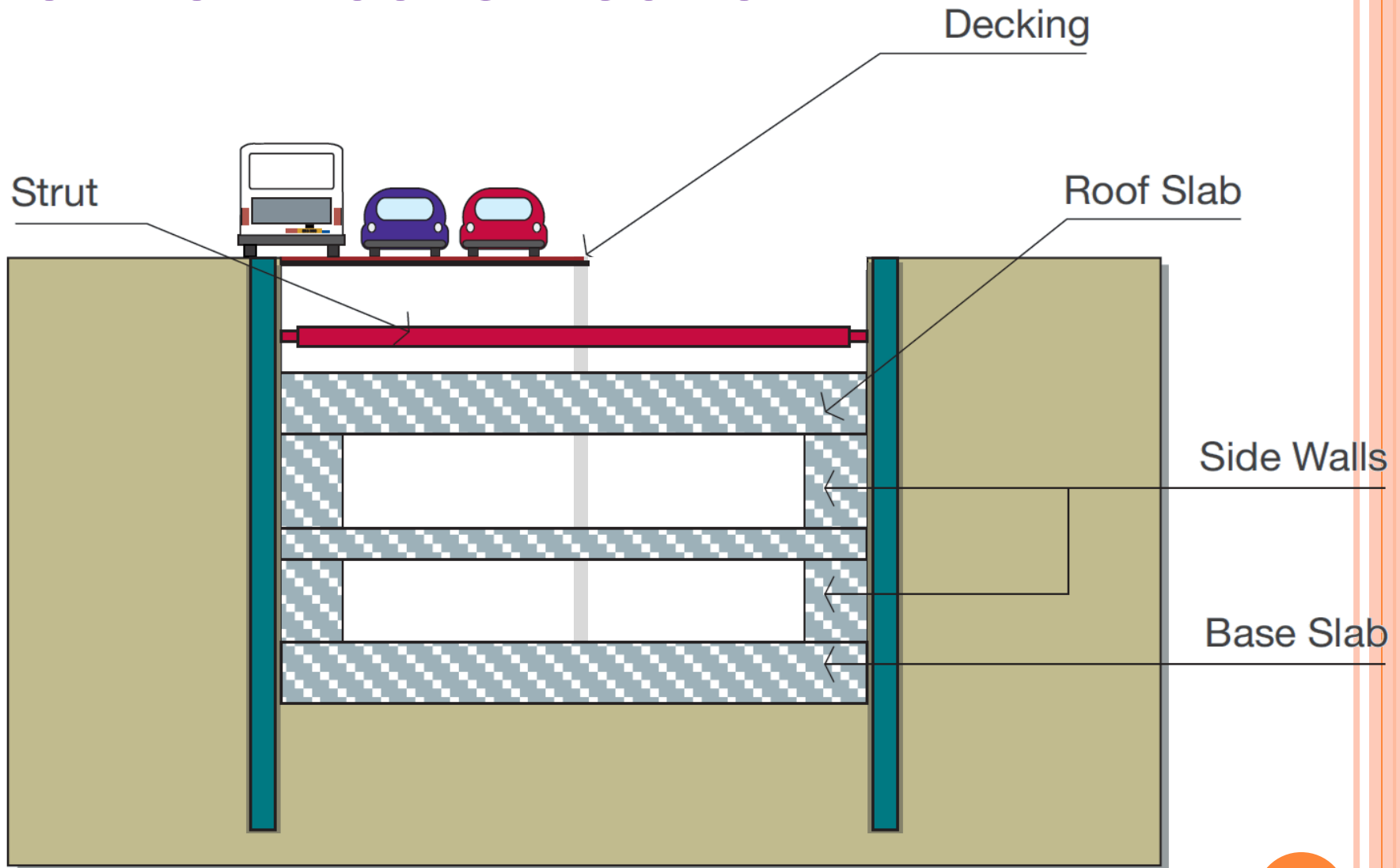
TOP-DOWN CONSTRUCTION



Construction of base slab



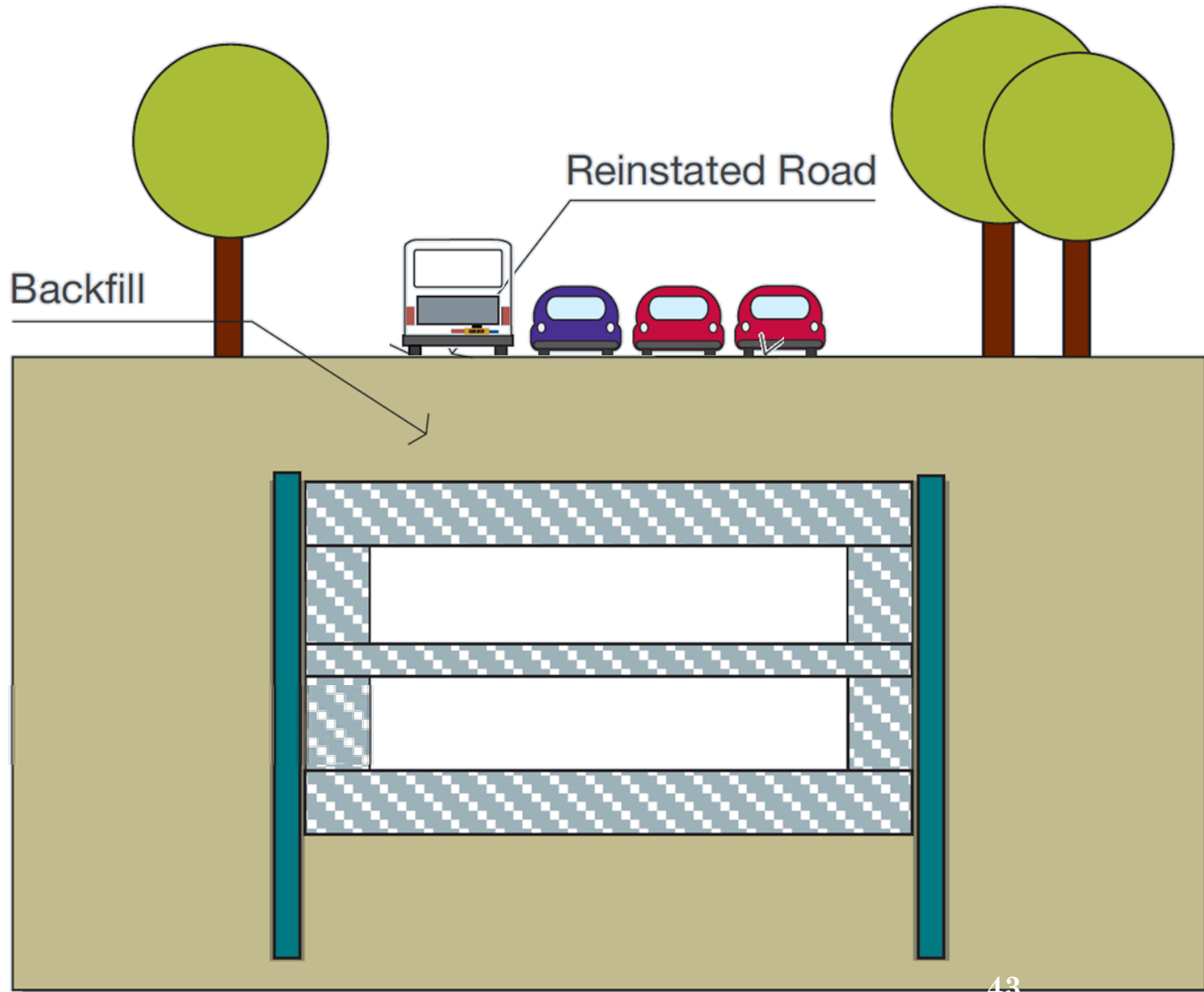
TOP-DOWN CONSTRUCTION



Construction of walls and closing of the access openings



TOP DOWN CONSTRUCTION



Removal of 1st level strut & reinstatement of ground

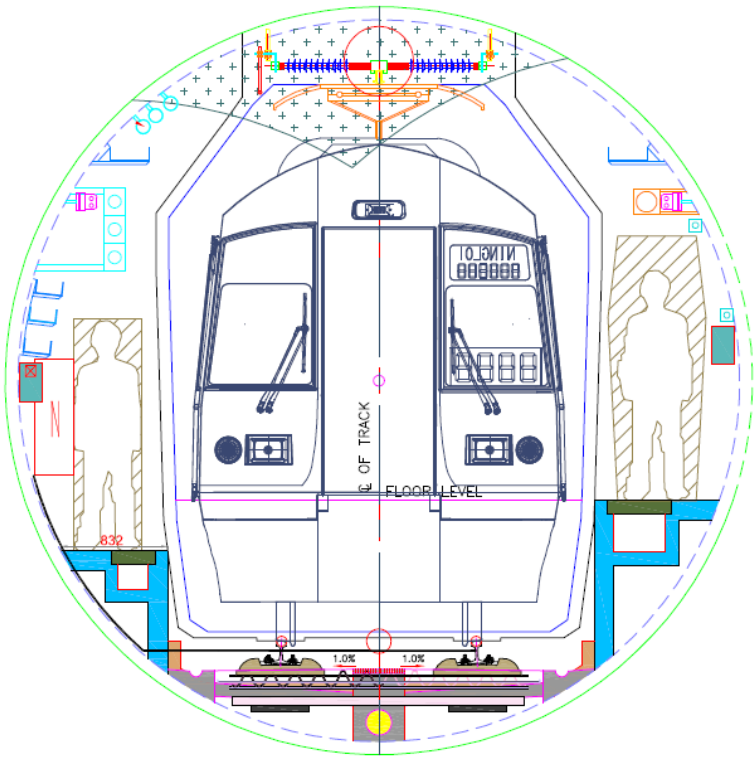


WATERPROOFING IN STATIONS



TUNNELS

METRO TUNNEL



TUNNELING IN SAND AND GRAVELS

- Loose sands and gravels in the presence of water tend to run into the excavation.
- This material can pass rapidly through small openings and fill a tunnel in a short period of time and can be easily over-excavated
- This will result in large settlements and face collapses.
- Closed-face TBMs are advantageous over Open-face TBM's.



TUNNELING IN CLAY AND SILTS

- In the presence of water some highly sensitive clays tend to flow. Below the water table a fluidised mixture of weak silty soil and water will flow as a liquid.
- Unstable and will require continuously support as a tunnel face.
- A Closed-face TBM is advantageous over the Open-face TBM for these conditions.



CLOSED FACE TBMs

- The main function of the closed – face TBM is to support the ground continuously during the total excavation and build cycle for a TBM
- Hold the surrounding ground behind the shield tail in balance by grouting the void around the lining while the TBM advances
- There are two types of Closed – Face TBMs; a Slurry TBM and an EPBM (Earth Pressure Balance Machine)



CLOSED FACE TBMs

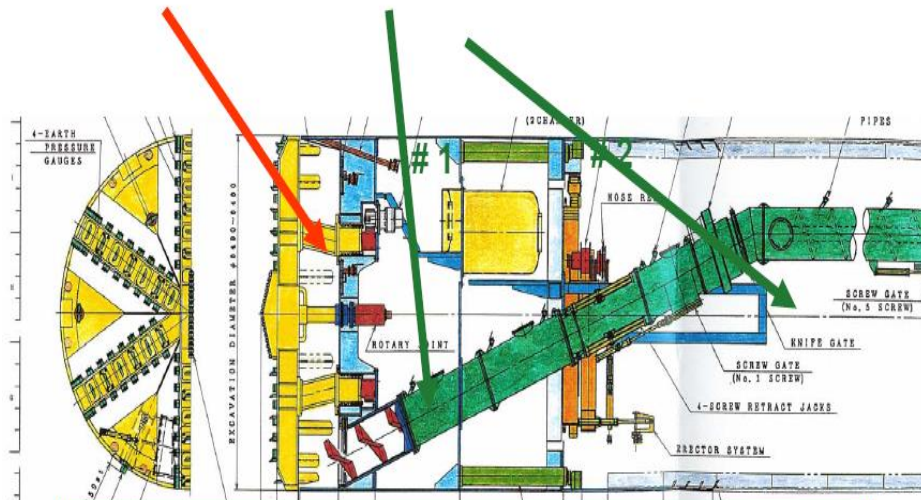


EARTH PRESSURE BALANCE MACHINE

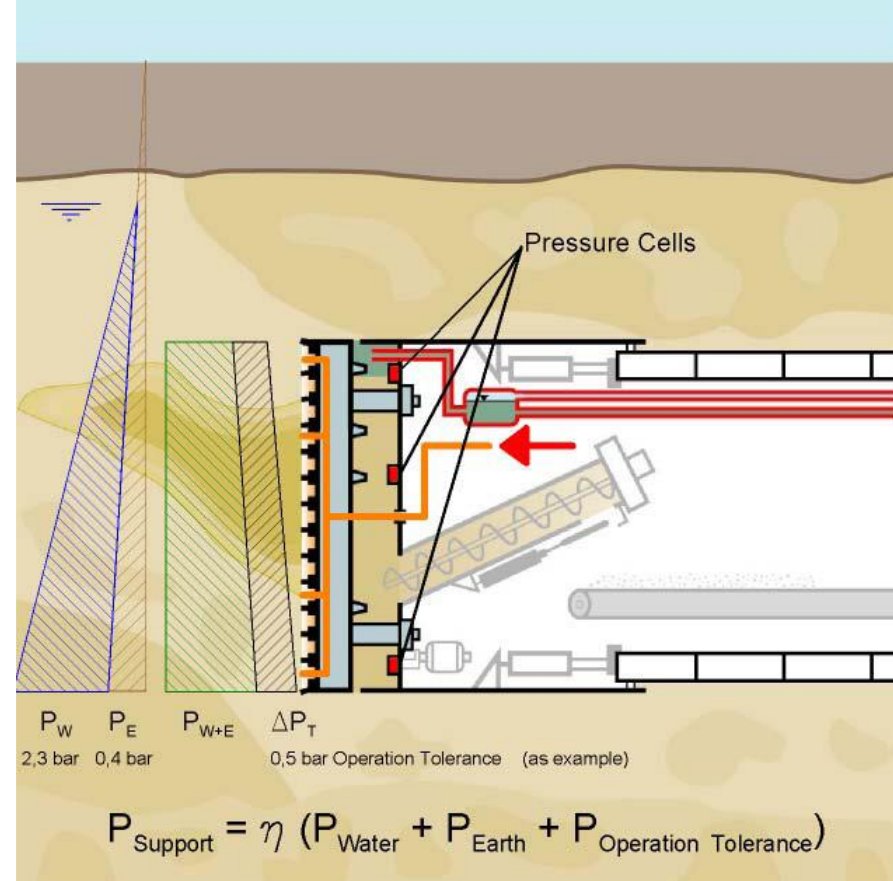
Earth Pressure Balanced Shield

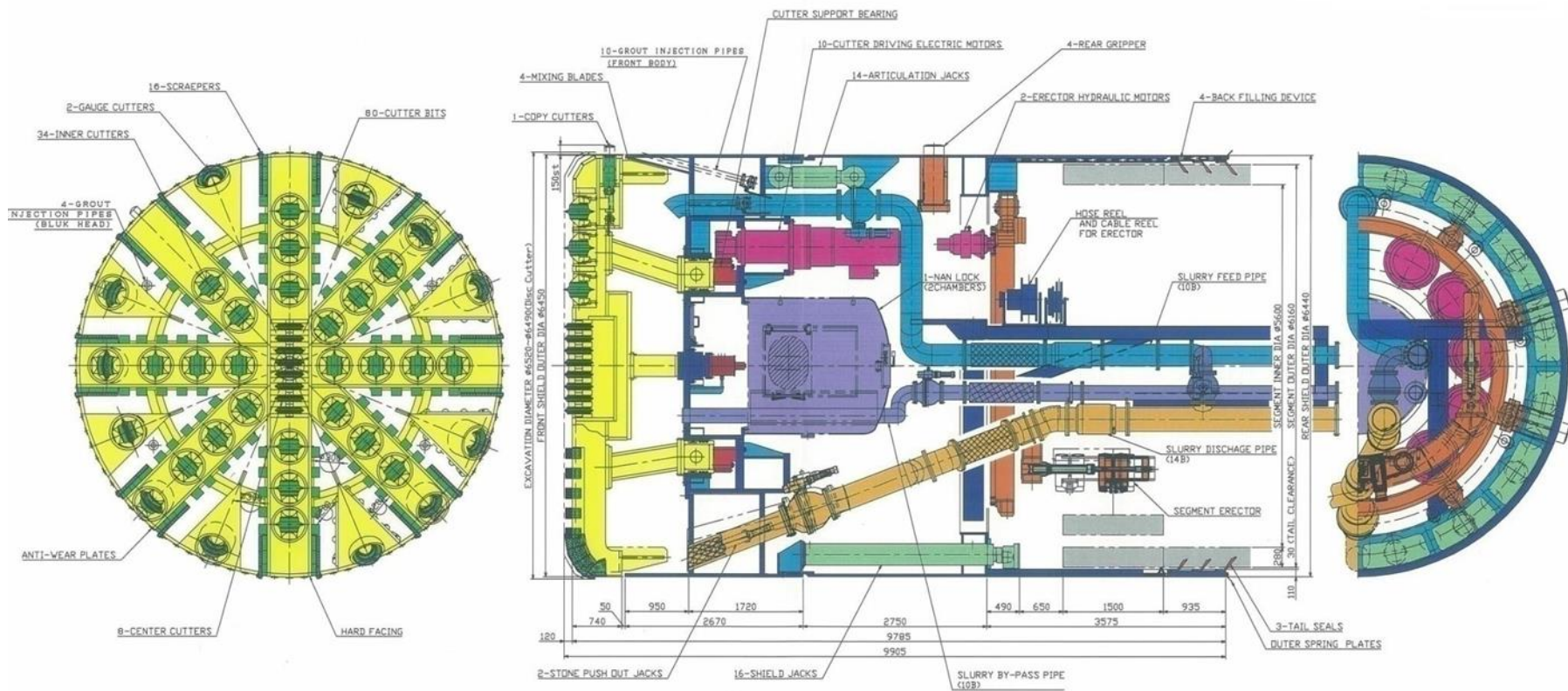
Muck pressurized in chamber supports face

Screws remove muck and provide back pressure



Segmental Lining is installed in tail end of the shield.
Shield is advanced by pushing against the installed lining



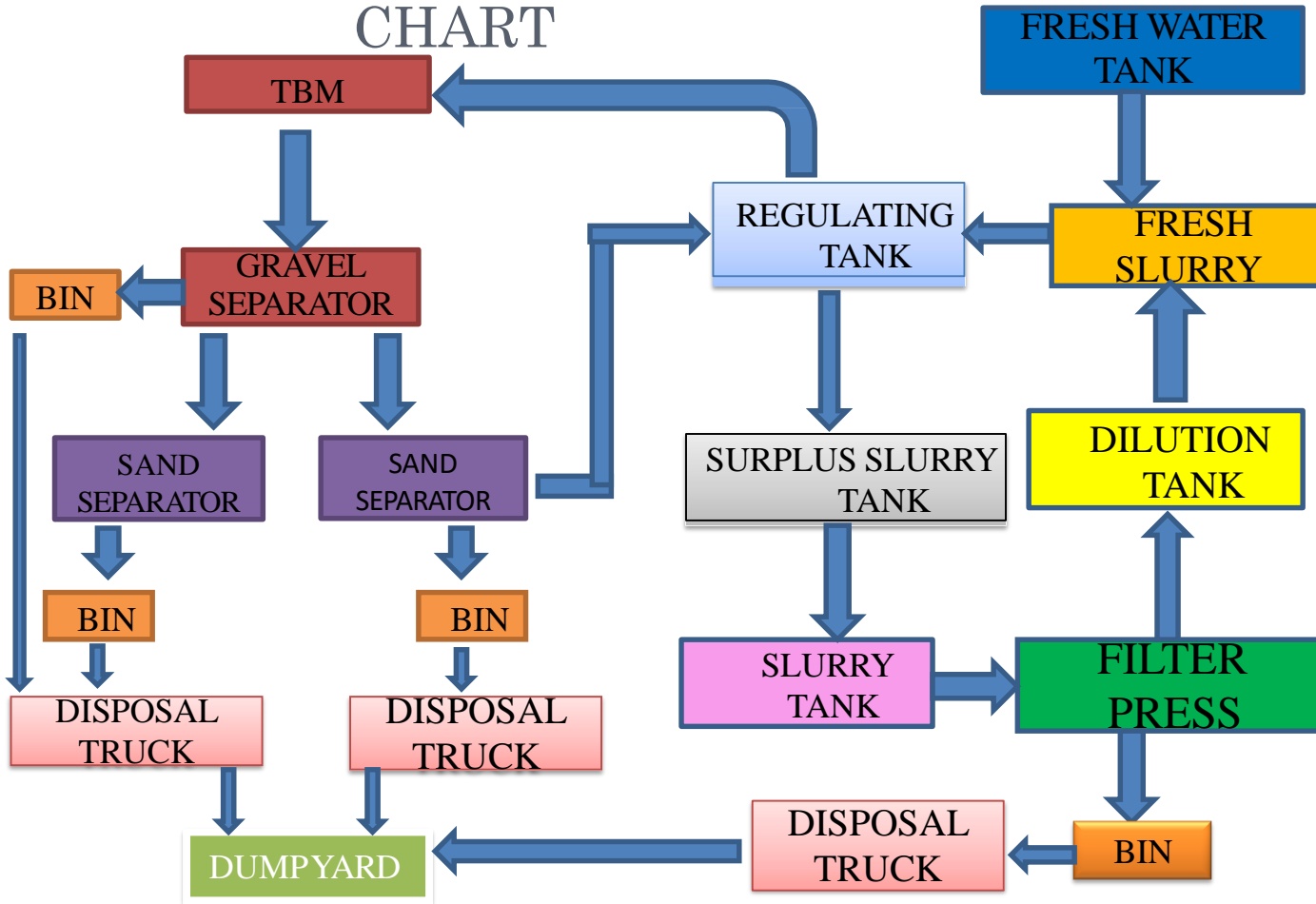


		SPECIFICATIONS OF ERECTOR		SPECIFICATIONS OF CUTTER	
OUTER DIAMETER	#6440mm	HYDRAULIC MOTOR	6.83kN-mx18MPax2pcs.	TYPE	Seal Dome Disk TYPE
PROPULSION FORCE	1160kN/m ²	POWER UNIT FOR ERECTOR	HYDRAULIC PUMP 100L/minx21MPax1pc.	CUTTER TORQUE	8285kN-m 8285~2574kN-m
SHIELD JACK SPEED	7.5 cm/min	ELECTRIC MOTOR	55kWx4Px50Hzx1pc.	TORQUE FACTOR	a=23.5 a=23.5~9.0
SHIELD JACK	2360kNx2200txx33MPax16pcs.	OIL TANK	COMMON USE WITH SHIELD	ROTATIONAL SPEED	0.8~1.8 min ⁻¹ 1.8~4.5 min ⁻¹
ARTICULATION JACK	2360kNx200txx33MPax14pcs.	LIFT JACK	105kNx650txx21MPax2pcs.	ELECTRIC MOTOR	120kNx4P/105.3x10 pcs.
HYDRAULIC PUMP	80/195L/minx33/21MPax1pc.	SLIDE JACK	105kNx750txx21MPax1pc.	TORQUE	74.8~30.6 kN-m
ELECTRIC MOTOR	55kWx4Px50Hzx1pc.	SUPPORT JACK	35kNx150txx 7MPax4pcs.	COPY CUTTER JACK	165kNx150txx21MPax1pc.
OIL TANK	3500L	HYDRAULIC PUMP	38L/minx21MPax1pc.	HYDRAULIC PUMP	23L/minx21MPax1pc.
REAR GRIPPER JACK	800kNx150txx35MPax4pcs.	ELECTRIC MOTOR	18.5kWx4Px50Hzx1pc.	ELECTRIC MOTOR	11kWx4Px50Hzx1pc.
		OIL TANK	COMMON USE WITH SHIELD	OIL TANK	COMMON USE WITH SHIELD

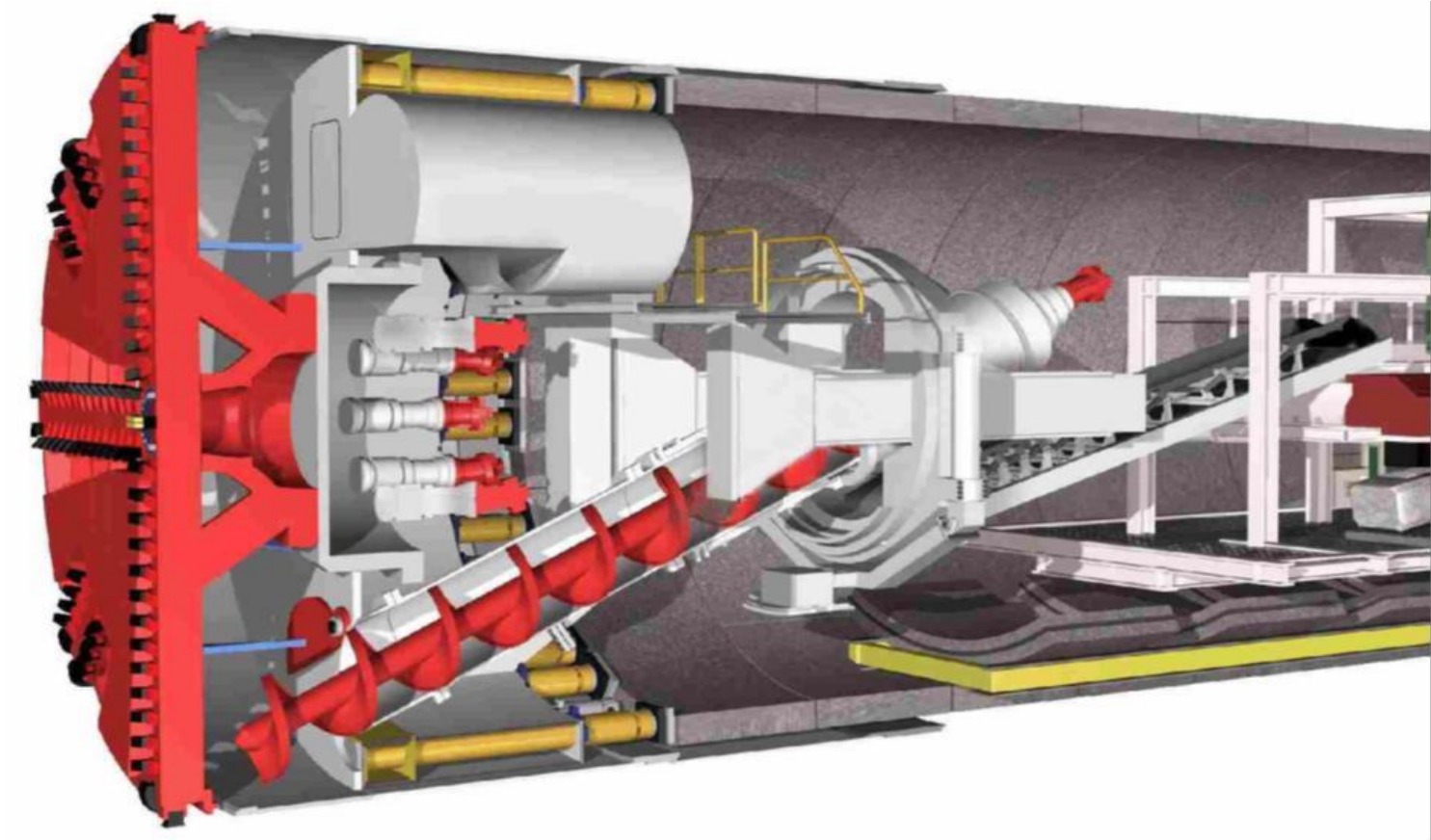
ARTICULATION ANGLE
VERTICAL=±1.8°
HORIZONTAL=±1.8°

L.No.	OWNER
#6440 HARD ROCK SLURRY TYPE TBM GENERAL ARRANGEMENT (SCALE) 1/30	
HITACHI ZOSEN CORPORATION CONSTRUCTION MACHINERY DESIGN DEPARTMENT - OSAKA JAPAN -	(DRAWN BY) (CHECKED BY)
DATE FEB. 06. '10	

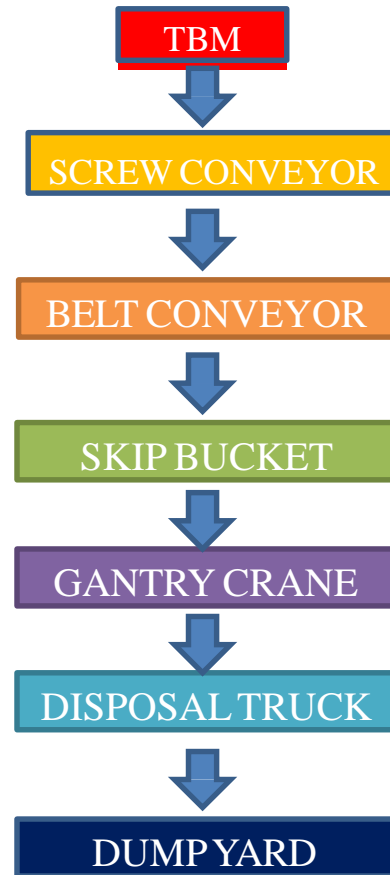
SLURRY FLOW CHART



L/S OF EPB MACHINE



EPB MUCK DISPOSAL FLOW CHART

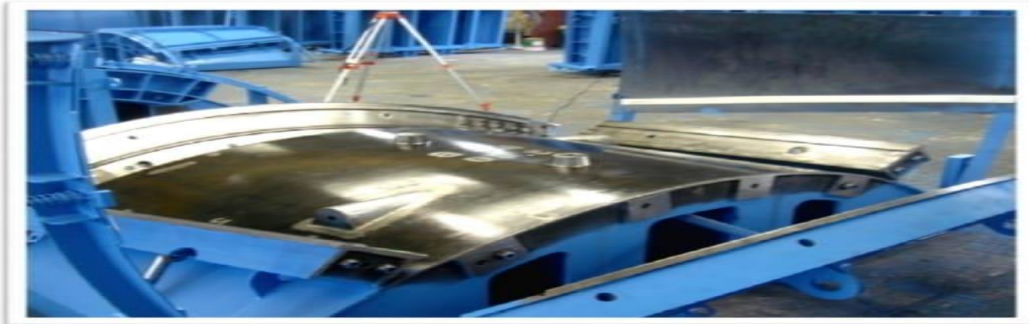


TUNNEL SEGMENT RING PRODUCTION

- Rebar cage fabrication
- Mould Operation
- Rebar placement and embedded component
- Concrete batching & placing
- Curing of concrete (Curing compound)
- De-moulding and segment marking
- Handling and storage
- Delivery and transportation



Fabrication of reinforcement



Mould inspection





Concreting after placing cage on mould

Finishing of extrados face



Application of curing compound after demoulding



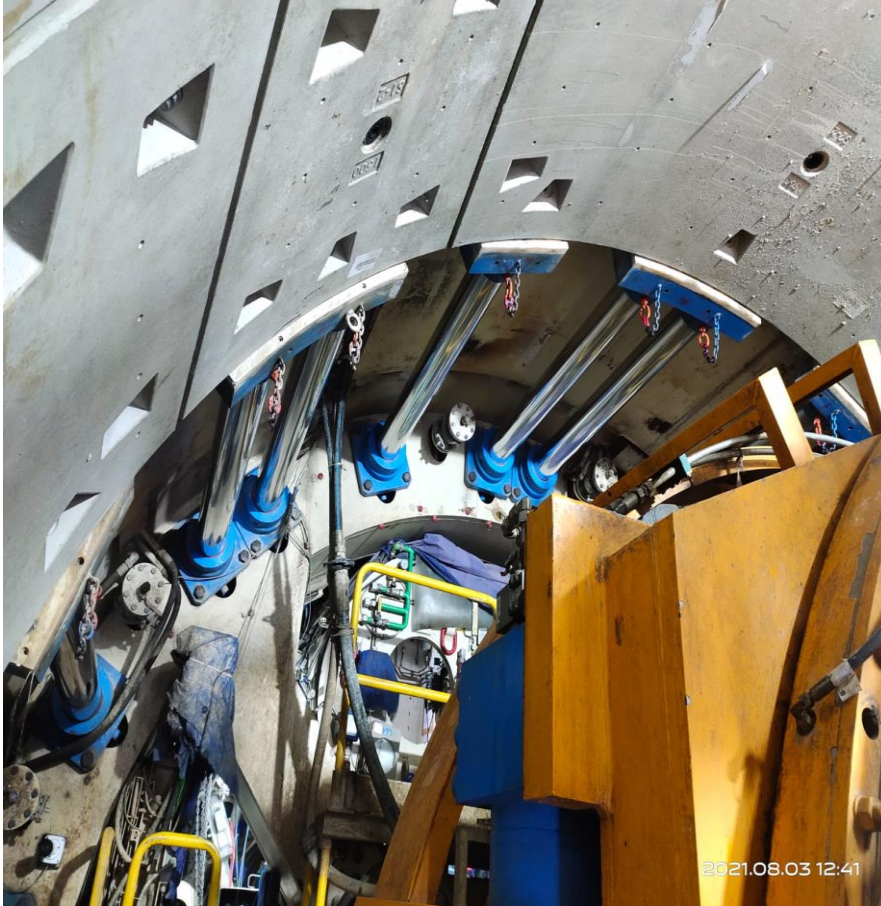
TRIAL RING ASSEMBLY



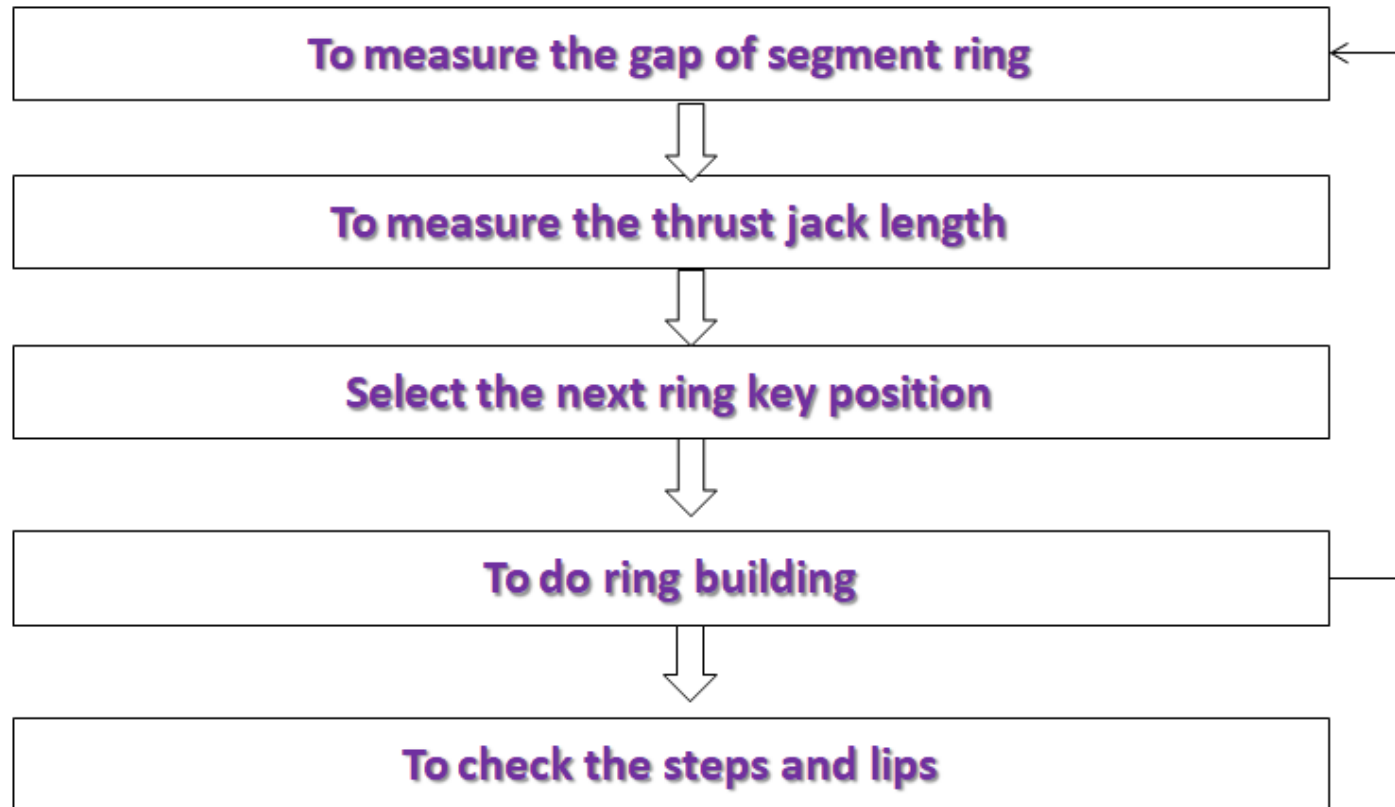
SEGMENT PERFORMANCE TEST



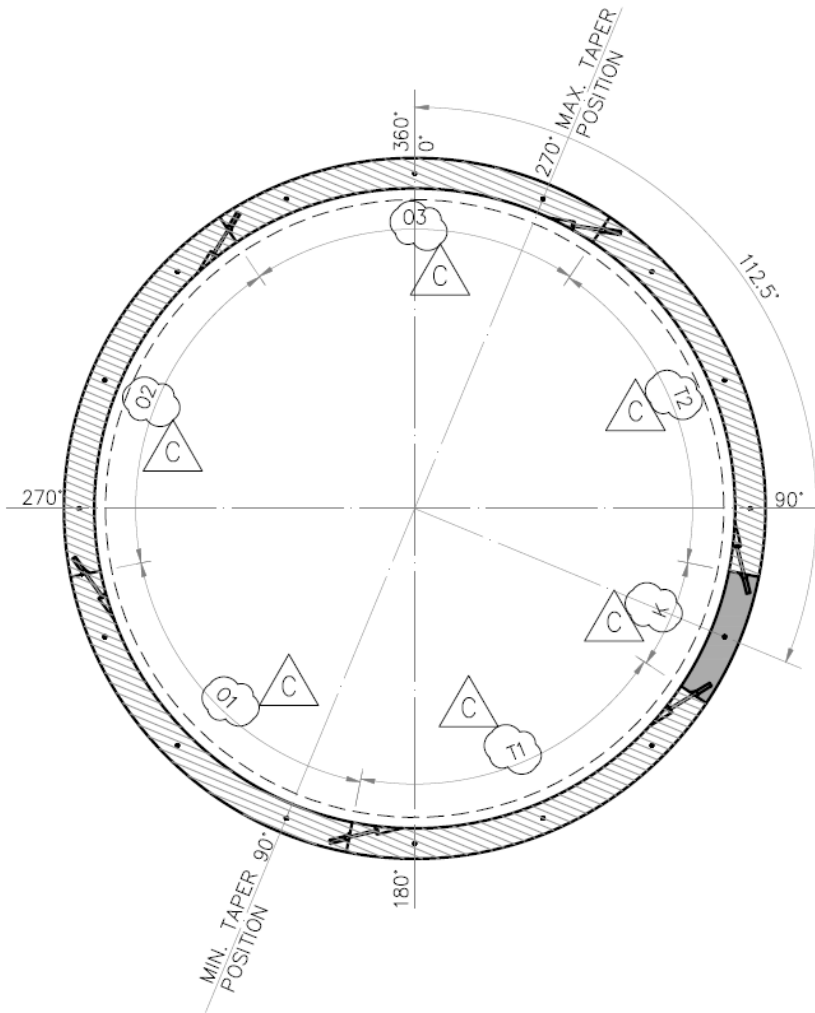
RING BUILDING



RING BUILDING PROCEDURE



TYPICAL RING ORIENTATION



- Internal dia. : 5.8 m
- External dia. : 6.35 m
- No. of segments: 6 (5+1 Key segment)
- Ring Type : Universal Rings

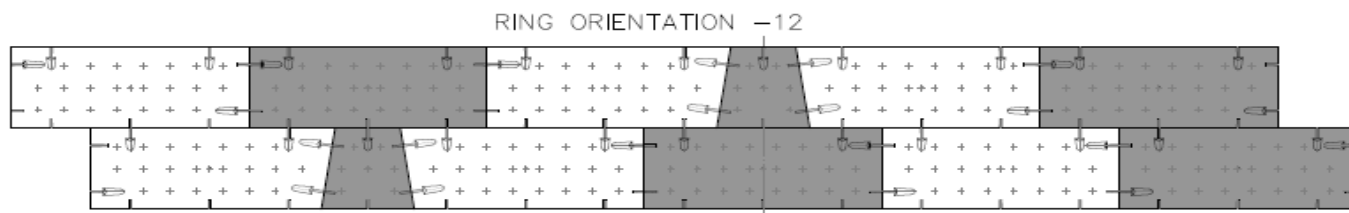
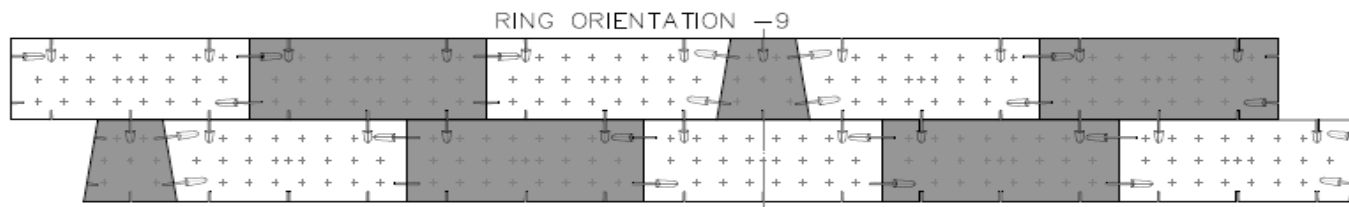
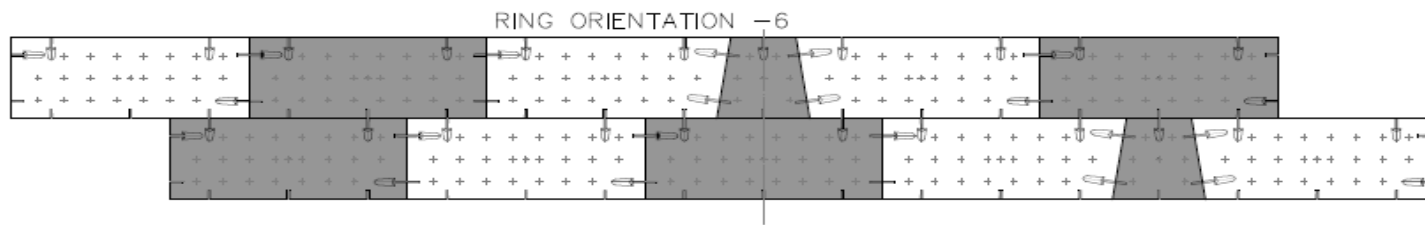
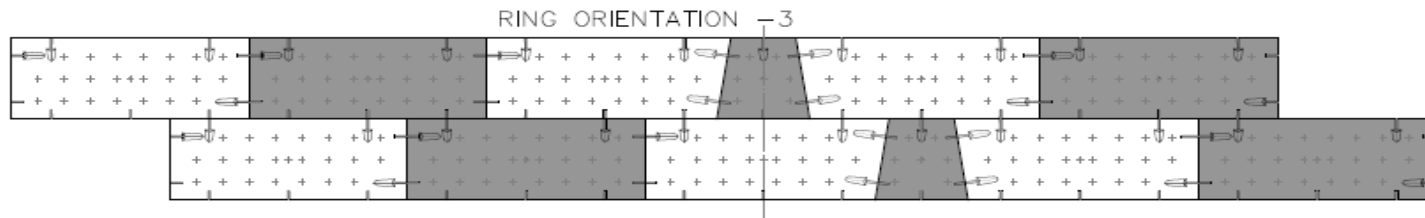


POSITIONING OF KEY SEGMENT

		RING ORIENTATION															
		0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
RING POSITION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.00	1			■			■			■			■			■	
22.50	2				■			■			■			■			■
45.00	3	■				■			■			■			■		
67.50	4		■				■			■			■			■	
90.00	5			■				■			■			■			■
112.50	6	■			■				■			■			■		
135.00	7		■			■				■			■			■	
157.50	8			■			■				■			■			■
180.00	9	■			■				■			■			■		
202.50	10		■			■				■			■			■	
225.00	11			■			■				■			■			■
247.50	12	■			■				■			■			■		
270.00	13		■			■				■			■			■	
292.50	14			■			■				■			■			■
315.00	15	■			■				■			■			■		
337.50	16		■			■				■			■			■	



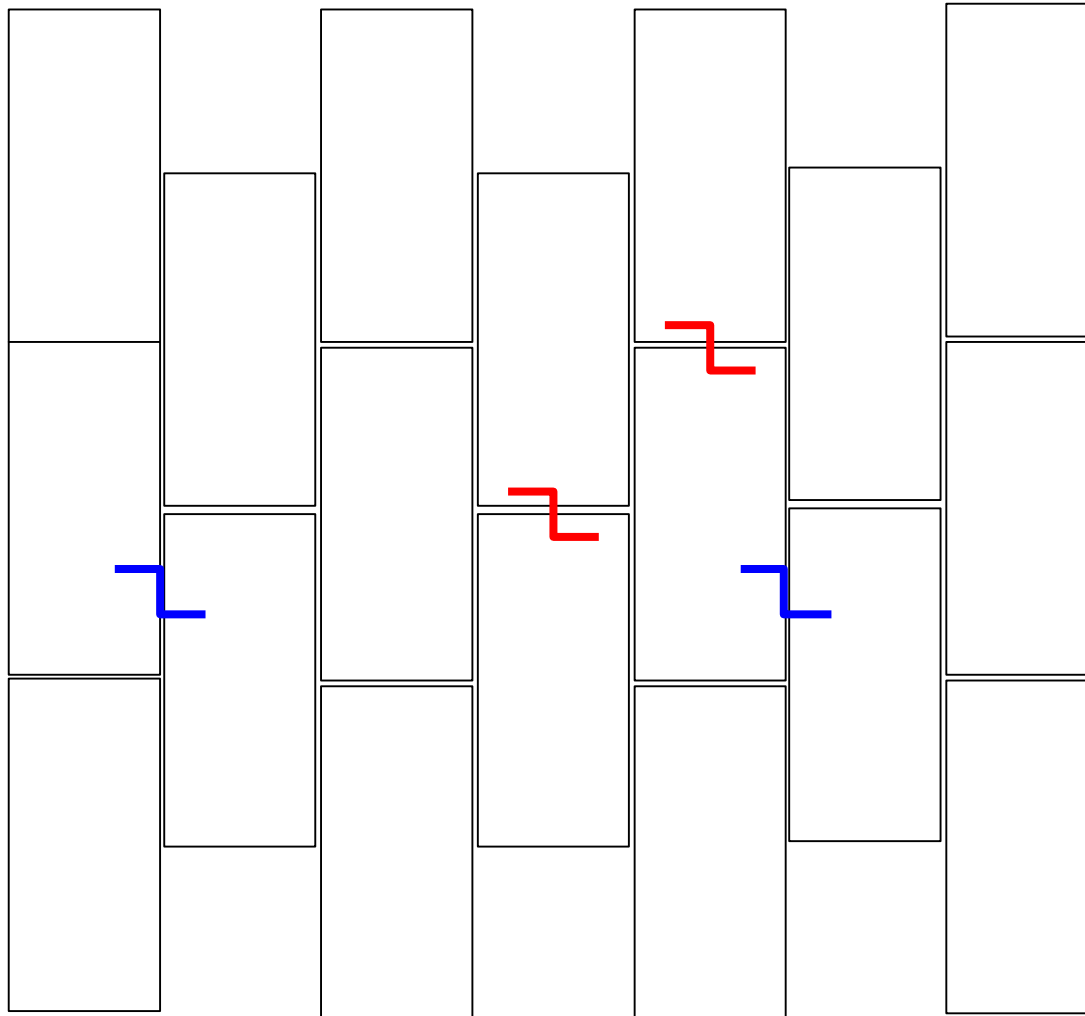
ALLOWABLE KEY POSITIONS



Check the steps and lips

Steps

Lips



INSPECTION



Steps



Lips



QUALITY MANAGEMENT SYSTEM

Quality

- Fitness for purpose
- Excellence
- Meeting Customer Expectations not just needs

Management

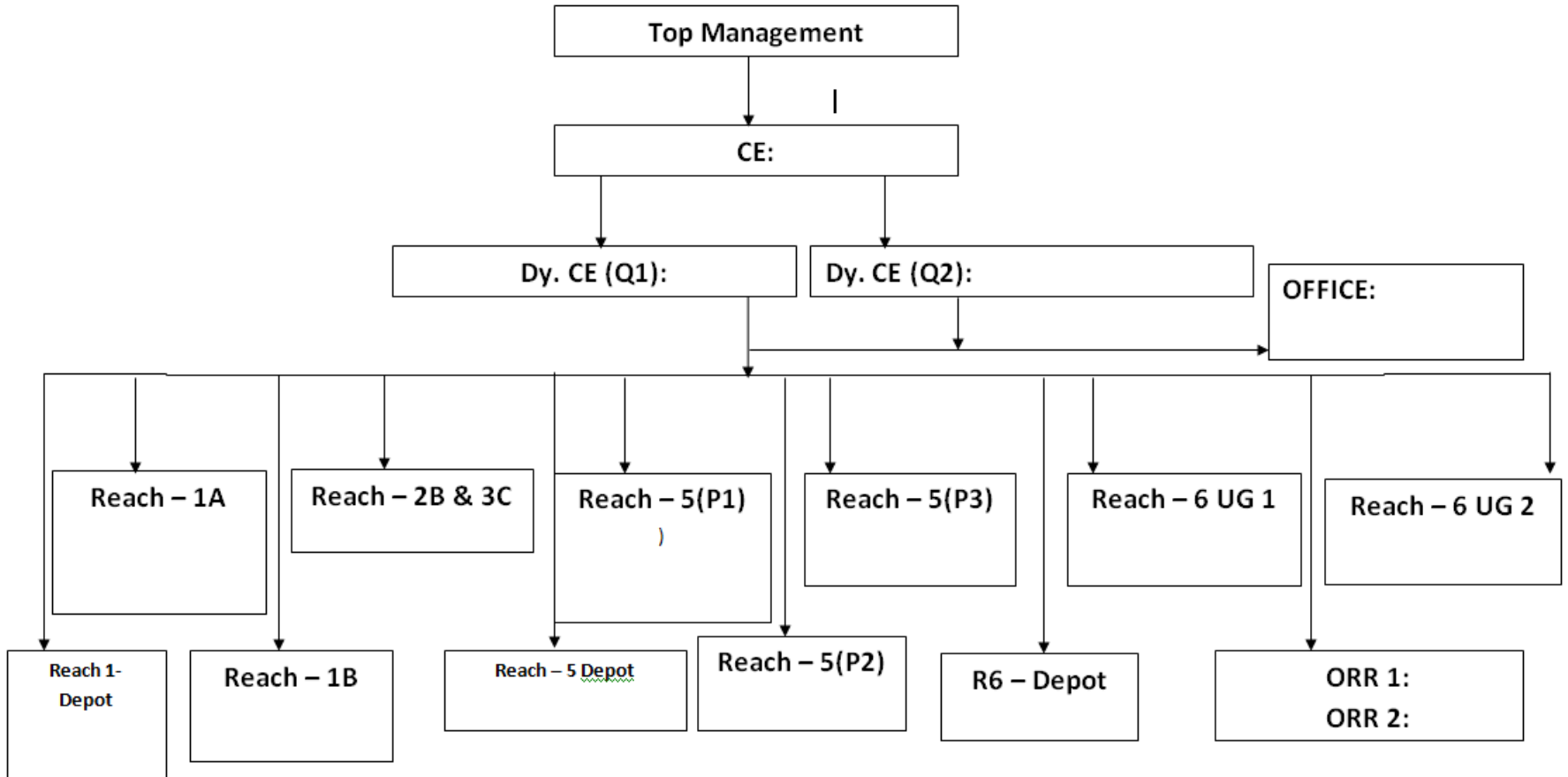
- Planning, Organizing, Directing, Controlling, Structuring

System

- Work culture
- Framework
- Policies & procedure



ORGANIZATION OF BMRCL QUALITY TEAM



ISO 9001:2008 MAIN CLAUSES

4. Quality Management System
5. Management Responsibility
6. Resources Management
7. Product Realization
8. Measurement, Analysis and Improvement



PROJECT QUALITY PLAN

- The objective of this construction procedure is for efficient execution to cast segments at casting yard and formulate as a summary of all quality related activities required to meet the terms of the contract as per the approved drawings and relevant technical specifications.
- The following aspects are taken care during the casting of the pier head segments by pier head moulds and intermediate segments by long line method.

For the sake of maintaining quality at the highest level, these are the following position at the pre-cast yard.

- Quality Control Incharge –
- Involves in quality pep talks, periodical demonstration of best practices in work.
- Arranges routine testing for concrete, reinforcement and other construction material as per inspection and test plan.
- Checks for the use of right material at the right place.
- Material source approval.
- Vendor development for construction materials.
- Finalization of mixed designs of concrete.
- Review of inspection plan and test plan.
- implementation of QMS at site.



INSPECTION/ MATERIAL TEST PLAN

Sl	Description/Tests	Reference Specification	Frequency	As per IS Code
1	Cement (OPC 53 grade)			
	I. Physical tests			
	a) Fineness	IS: 12269	1. At the beginning for approval of each source and change of source. 2. Once for every lot of 50MT. 3. Once in 3 months, if cement bags unused.	Each source/ change of course/ every day (IS 3535)
	b) Standard consistency	IS: 12269		
	c) Initial setting time	IS: 12269		
	d) Final setting time	IS: 12269		Each source/ change of course/ every day (IS 3535)
	e) Soundness test	IS: 12269		Each source/ change of course/ every day (IS 3535)
	f) Density	IS: 12269		
	g) Compressive strength test	IS: 12269		Each source/ change of course/ every day (IS 3535)
	i. 72Hrs.	IS: 12269		
	ii. 168 Hrs.	IS: 12269		
	iii. 672 Hrs.	IS: 12269		
	II. Chemical tests			Each source/ change of course/ every week (IS 3535) for packaging
	a) Total loss on ignition	IS: 12269	1. At the beginning for approval of each source and change of source. 2. Once for every lot of 50MT. 3. Once in 3 months, if cement bags unused.	
	b) Insoluble residue	IS: 12269		
	c) Magnesia	IS: 12269		
	d) Tricalcium Aluminate	IS: 12269		
	e) Total chloride content	IS: 12269		
	f) Ratio of lime to percent of Silica, alumina and Iron Oxide	IS: 12269		
	g) Ratio of percent of alumina to Iron oxide	IS: 12269		
	h) Total Sulphur content	IS: 12269		
	i) Lime saturation factor	IS: 12269		
2	Fine Aggregate			
	1. Source approval	As per tender / IS: 383	Before commencement of work	
	2. Sieve Analysis/gradation.	IS: 383 & 2386	Once in a day	Each source/ change of course/ every month (IS 4926)
	3. Deleterious materials.	IS: 383 & 2386	Change of source/Once in three	
	4. Silt content	IS: 383 & 2386	Change of source, weekly	
	5. Specific gravity & Density	IS: 383 & 2386	Change of source/Once in three	
	6. Water absorption	IS: 383 & 2386	Change of source.	Each source/ change of course/ once in 3 months (IS 4926)



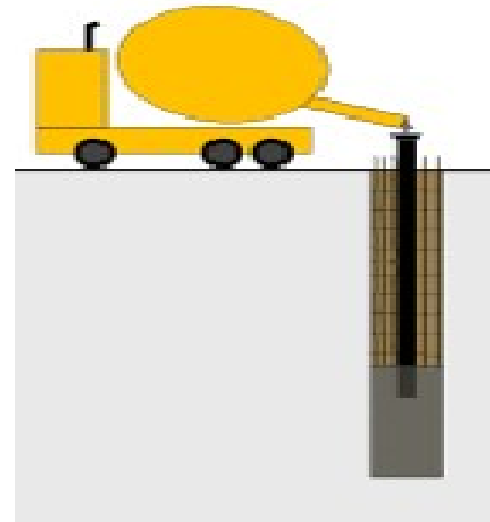
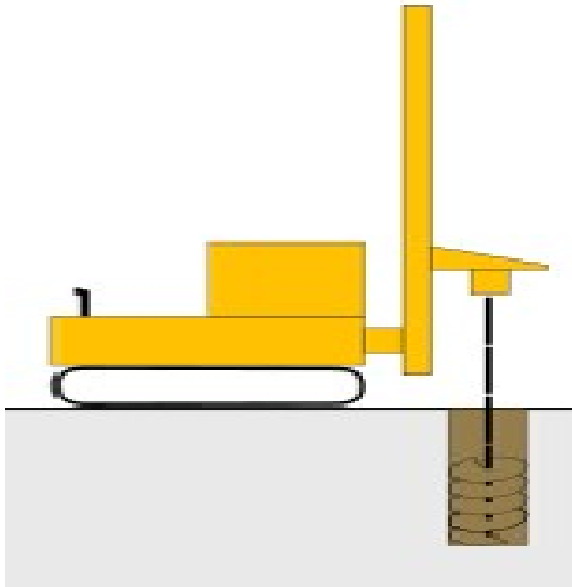
ITP OF I GIRDER POST TENSIONING

Sr. No.	Description of Activities	Norms / code of Reference	Acceptance criteria	Type of check	Frequency of check/test	Type of records/Ref No.	SCOPE OF INSPECTION	
							ITDC	BMRC
1	Design Mix							
	(a) Approved Source	IS 10262:2009 and Technical Specification	As per Technical Specification	Visual & Design Calculation Checking & Testing	Each Grade/ Mix	Trial Mix register	P	W
	(b) Cement content & Water Cement ratio		As per Technical Specification					
	(c) Workability and Strength		As per Technical Specification					
2	PRECAST I GIRDER							
	(a) Concrete Mix	IS:456 & IS:10262, SP 23 specification and BOQ	Approved Design mix	Document	Ensure same for each pour	Batch Report	P	RM
	(b) Method of mixing		By batching plant	Visual	Random	CONCRETE POUR CARD FOR PRECAST (QR-BMRCL(R1B)/26A)	P	RM
	(c) Method of transportation		As per approved methodology	Visual	random		P	RM
	(d) Method of placing		As per approved methodology	Visual	random		P	RM
	(e) Inspection as per parameters mentioned in pour card such as workability, Temperature		As per approved methodology and Pour card	Visual and dimensional	For each pour		P	H
	f) Cube test	1 Set for conc 1-5 cum, 2 sets for 6-15cum, 3 sets for 16-30cum, 4 sets for 31-50cum, 4 and one additional set for every additional 50cum or part thereof	a) Each sample should have test strength more than characteristic strength. b) In case of 1 or more samples non conformation min of group of 4 non overlapping consecutive test results in N/sq.mm should be greater of (f _{ck} +0.825 SD) or (f _{ck} +3 N/ sq.mm)	Visual & measurement	As per 7 days, 14Days & 28 Days, Maturity	COMPRESSIVE STRENGTH OF CONCRETE (QR-BMRCL(R1B)/13)	P	W
	g) Permeability test	2 sample per day until 60 samples have been made for each grade of concrete	Max depth of penetration 25mm	External Test Report	min 2 sample per day	External/ lab report	P	R
	h) Fixing of Lifting hook	Drawing & Specifications.	As per drawing/specification	Dimensional check	each pour		P	RM
	i) Form work	Specifications, approved methodology & drawings	Specifications, drawings & approved methodology	Dimensional check	Each Girder		P	RM
	j) Reinforcement works	As per approved BBS	Minimum specified cover shall be maintained and spacing of bars \pm 10 mm	Visual and measurement	Each Girder	REINFORCEMENT INSPECTION CHECKLIST(QR-BMRCL(R1B)/101)	P	H
	k) Concrete Inspection	As per approved method statement	As per approved method statement	Visula	each pour	Concrete inspection checklist(QR-BMRCL(R1B)/103)		



Quality checks- PILING

- a) Relevant drawings
- b) Verifying co ordinates
- c) Verticality of bore
- d) Polymer properties
- e) Bore termination levels
- f) Rebar cage
- g) Concreting
- h) Bore log registers



QUALITY CHECKS – PILE CAP, PIER, PEDESTALS, I GIRDER, SEGMENTS, SLABS, BEAMS, COLUMNS

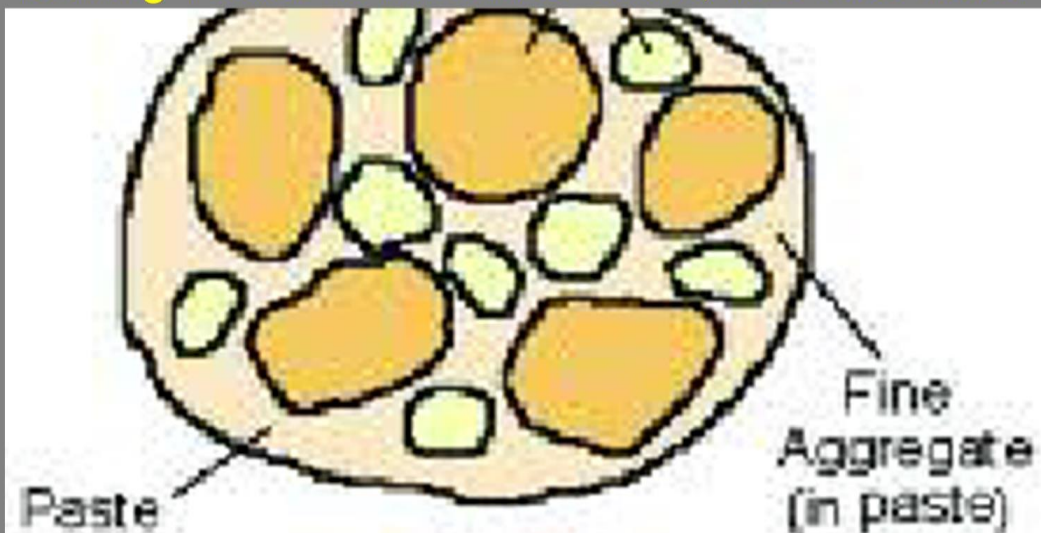
- a) Relevant drawings
- b) Rebar works
- c) Shuttering
- d) Machinery availability
- e) Concreting processes
- f) Curing



QUALITY IN MIX DESIGN

- Approval of source of ingredients
- Min. cement content
- Usage of GGBS
- W/C

Only about half the total water used in mix is used for hydration; remaining evaporates, leaving voids. To minimize voids, use less water



CHECKLISTS

Check lists
i. Request for inspection (RFI for activities/ Sub activities)
ii. Survey work, works inspection check list (By Contractor)
iii. Piling activity
1) Pile coordinates checklist (Checked by Contractor)
2) Survey work inspection checklist
3) Pile coordinates checklist
4) Permission for boring
5) Pile boring details
6) Reinforcement inspection checklist (piling)
7) Permission for cage lowering
8) Bar bending schedule for pile
9) Tremmie chart (piling)
10) Removal of tremmie pipes (piling)
11) Pile pour card
12) Concrete batch sheet piling
iv) Pile cap activity
1) Form work inspection checklist (pile cap)
2) Coordinates for pile cap for pier no.
3) Reinforcement inspection check list (pile cap)
4) Bar bending schedule (pile cap)
5) Concrete inspection check list (pile cap)
6) Concrete pour card (pile cap)
7) Concrete batch sheet (pile cap)
8) Post concrete inspection checklist (pile cap)





BANGALORE METRO RAIL CORPORATION LTD
RT-02



FORMAT: BMRCL/RT-02/QC-F92/R0

Client : Bangalore Metro Rail Corporation Ltd.

Contractor : L&T Construction (Infrastructure IC)

CONCRETE INSPECTION CHECKLIST

Structure : Date of Inspection :

Structure No : Structure Type :

Drawing No : Location :

Sr. No.	Activities/Items to be inspected	Yes	No	Remarks
1.	Is the Reinforcement & Formwork is approved by the Client			
2.	Is the Concrete pour area is cleaned & unwanted material is removed from pour area			
4.	Is the equipment available for placing & compaction of concrete			
5.	Is the concreting gang (Unskilled labours/Mason) including carpenter, steel fixer mechanics and electrician present			
6.	Are the safety arrangements & lighting (In case of Night work) are adequate			

L&T Representative
Date:

BMRCL Representative
Date:

SHIVAYOGI .S.K.
Dy. Chief Engineer
R6-UG / BMRCL



BANGALORE METRO RAIL CORPORATION LTD
RT-02



FORMAT: BMRCL/RT-02/QC-F111/R0

Client : Bangalore Metro Rail Corporation Ltd.

Contractor : L&T Construction (Infrastructure IC)

Concrete Pre Pour Checklist

Structure : Date of Inspection :

Structure No : Structure Type :

Drawing No : Pour No :

Sr. No.	Activities/Items to be inspected	Yes	No	Remarks
1	Approval of Materials and Concrete Mix			
2	Survey Checked as per Approved Drawings			
3	Excavation/Trenching/Filling and Surface preparation as per Drawing			
4	Sprinkling water/PCC bedding as per Drawing			
5	Bar Bending Schedules prepared and approved			
6	Reinforcement placing, tying with specified binding wire and welding, if required, as per BBS/Drawing and cleaning of reinforcement, Epoxy coating, if any, as required etc.,			
7	Provide adequate no. of Cover Blocks of required thickness			
8	Position of Spacers, Chairs, Splices, Laps etc as per BBS/Drawings			
9	Position of Construction Joints, Embedment plates, Pipe inserts, if any, etc. as per Drawing			
10	Alignment/Location Post-Tensioning Ducts, Accessories etc. as per Drawing			
11	Check for Line, level, alignment, plumb, supports and mould release oil etc. of Shuttering			

SHIVAYOGI .S.K.
Dy. Chief Engineer
R6-UG / BMRCL



BANGALORE METRO RAIL CORPORATION LTD
RT-02



FORMAT: BMRL/RT-02/QC-F09/R0

Client : Bangalore Metro Rail Corporation Limited

Contractor : L&T Construction (Infrastructure IC)

CONCRETE POUR CARD

Drawing no. : Date :

Structure :

Location :

Segment :

Grade of concrete :

Quantity of concrete :

Cement Required in MT :

Date & time of start :

Expected time of completion:

Method of

transportation :

Method of mixing :

Method of pouring :

Rate of pour achieved : Cum/hour.

Water- cement ratio :

Admixture : % Retarder/ super plasticizer

Slump observed :

1
mm

2
mm

3
mm

4
mm

5
mm

6
mm

No. Of cubes taken

ID Marks on cubes :

APPROVED TO POUR : YES/ NO

L&T Representative
Date:

BMRL Representative
Date:

1/2 1/2



BANGALORE METRO RAIL CORPORATION LTD
(RT-02)



Client :- Bangalore Metro Rail Corporation Limited

Contractor :- L&T Construction (Infrastructure IC)

Format No: BMRL/RT-02/QC-F02/R0

Location: Date: Structure: Pour Detail:

RECORD OF CONCRETE PLACED

Sl. No.	Transit Mixer No.	Batching plant despatch time	Arrival time at Placement point	Pouring time		Temp in °c	Slump (mm)	Pour Quantity(cum)		Remarks
				Start	Finish			Total	Cumulative	

L&T Representative BMRL Representative



BANGALORE METRO RAIL CORPORATION LTD
RT-02



FORMAT: BMRCL/RT-02/QC-F91/R0

Client : Bangalore Metro Rail Corporation Ltd.

Contractor : L&T Construction (Infrastructure IC)

Post Pour Inspection

Structure : Date of Inspection :

Structure No : Structure Type :

Drawing No : Pour No :

Sr. No.	Activities/Items to be Inspected	Yes	No	Remarks
1 During Concrete Check				
1.1	Slump checked complies with MS, ITP & Codes			
1.2	Temperature checked complies with MS & ITP			
1.3	Cube sampling check complies with ITP			
1.4	Concrete placed in final location before compaction			
1.5	Unusual stoppages during concreting			
1.5	a) No			
	b) Yes			
	Duration - From : To:			
	Reasons			
1.6	Measures taken before resumption of concreting			
2. Post Concrete Check				
2.1	Whether the concrete protected with polythene sheet during the temperature monitoring			
2.2	Check for stripping of formwork/support etc. after specified during of stripping time			



BANGALORE METRO RAIL CORPORATION LTD
RT-02



2.3	Laitance removed from/aggregate exposed at the construction joint surface			
2.4	Rebar's soiled by splashed concrete cleaned			
2.5	Starter bars not bent during from removal			
2.6	Concrete surface checked			
2.7	Whether initial curing arrangements done			
2.8	Check for curing by ponding or covering with wet hessian cloth/ sprinkling water to keep the exposed concrete surface moist to specified curing period			
2.9	Check of any surface defects is. Honeycombing, hair cracks, air voids, etc., if any			
2.10	Check of any embedment parts positioning			
3. As Build Survey Check				
3.1	As build checked and recorded			
Remarks:				

L&T Representative
Date:

BMRCL Representative
Date:

WHAT IS AN AUDIT ????

- Audit is a process to verify the management's commitment to implement systems, to produce a quality deliverable.
- It is required by all Executing Contractors, to conduct :
 - INTERNAL AUDIT - once every 3 months
 - EXTERNAL AUDIT - once in every calendar year.



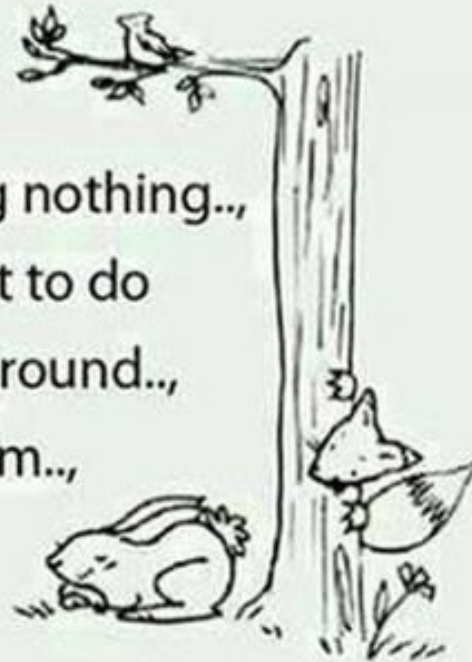
HUMOUR

- *Arguing with an ISO 9001 auditor is like wrestling with a pig in mud . . .
Sooner or later you realize the pig is enjoying being in the mud!*



Management Lesson

"A crow sat on a tree doing nothing.,
When a Rabbit thought to do
the same & sat on the ground.,
A fox came & ate him.,



MORAL: - To sit & do nothing.,
You need to be on the TOP...."



Look at this

A SMALL TRUTH TO MAKE LIFE 100 %

If A=1, B=2, C=3, D=4, E=5, G=6, H=7,Z=26.

If you take

a) HARDWORK= H+A+R+D+W+O+R+K

$$8+1+18+4+23+15+18+11= 98\%$$

B) KNOWLEDGE= K+N+O+W+L+E+D+G+E

$$11+14+15+23+12+5+4+7+5= 96\%$$

C) LUCK = L+U+C+K

$$12+21+3+11 =47\%$$

D) THEN IT MUST BE MONEY = M+O+N+E+Y

$$13+15+14+5+25= 72\%$$

E) LEADERSHIP= L+E+A+D+E+R+S+I+P

$$12+5+1+4+5+18+19+9+16= 89\%$$



To go to the top, to that 100% ,what we really need is

• ATTITUDE

$$\begin{aligned} & \mathbf{A+T +T +I+T +U +D+E} \\ & \mathbf{1+20+20+9+20+21+4+5 = 100\%} \end{aligned}$$

It is OUR ATTITUDE towards Life and Work that makes OUR Life 100% !!!

**Change Your Attitude towards work
And You can Change Your Life !!**

!

Now that you know the answer... Go for it



THANK YOU

**ANY
QUESTIONS?**

