



Bangalore Metro Rail Project PH-2A&2B (ORR-Airport Metro)

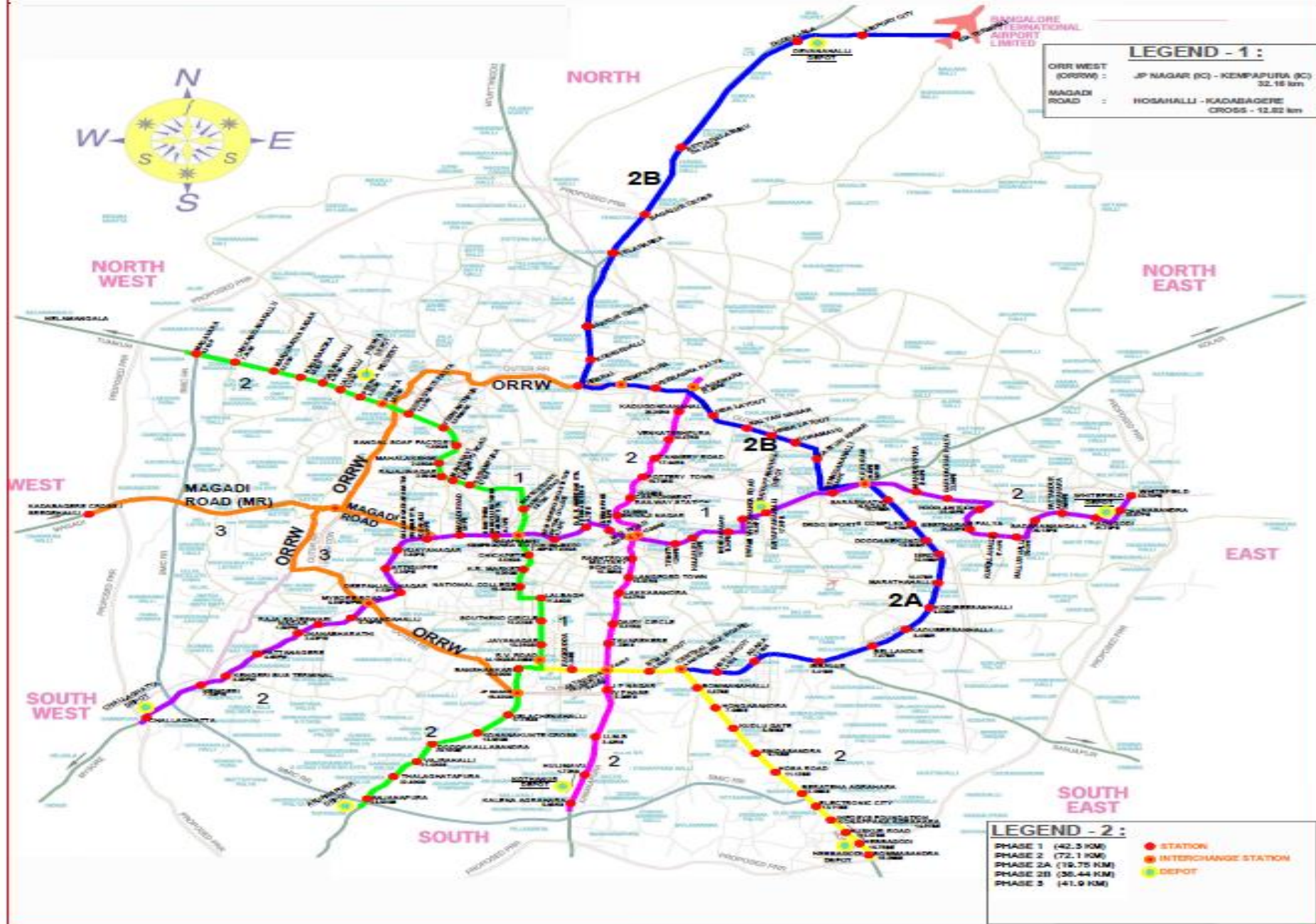


Presentation to ORRCA Dt:17.10.22

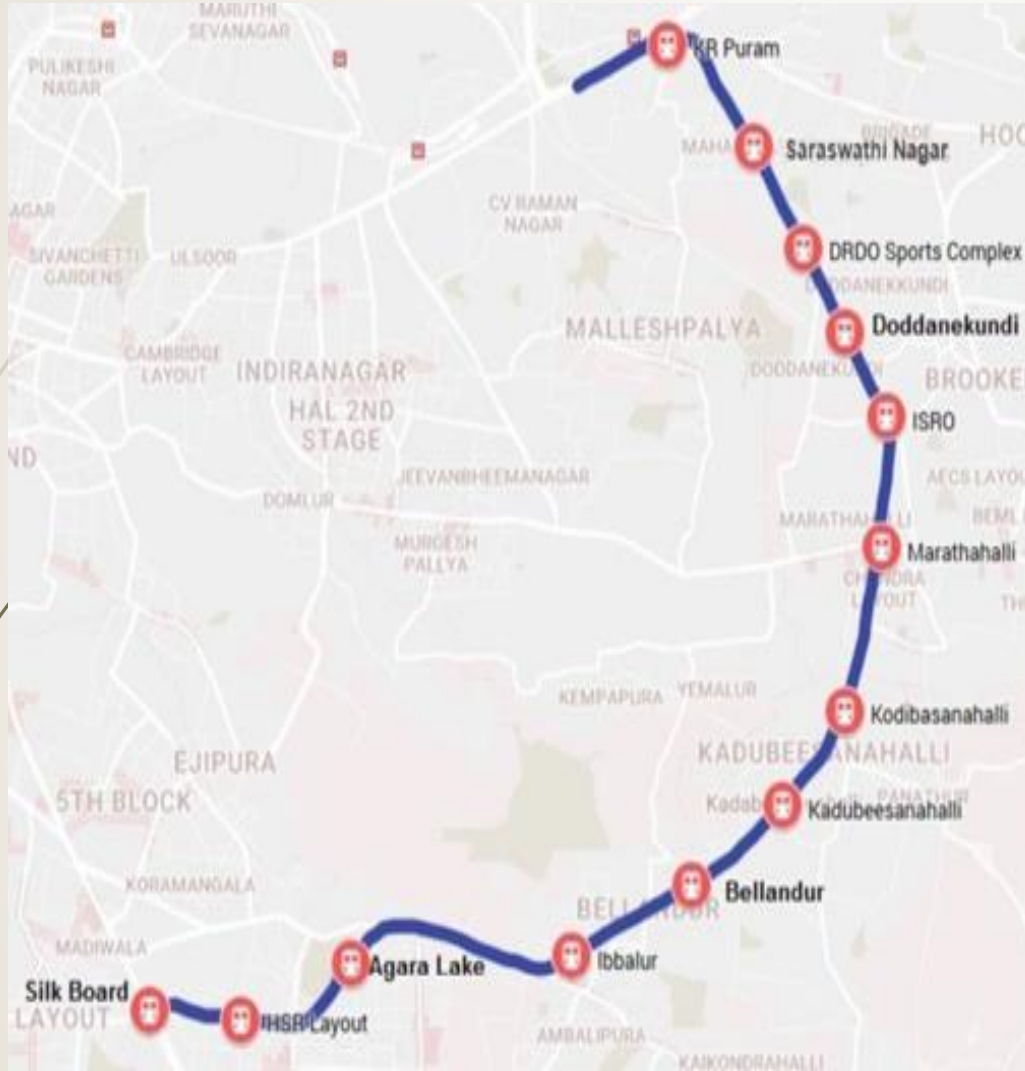
ORR – PHASE - 2A - PACKAGE-1&2
(CSB to K R Puram)
19.75 km VIADUCT + 13 STATIONS

AIRPORT – PHASE – 2B - PACKAGE-1,2 &3
(K R Puram to Airport)
38.44 VIADUCT + 17 STATIONS

BANGALORE METRO RAIL NETWORK PHASE 1, 2, 2A, 2B and 3



GENERAL ALIGNMENT OF ORR-PH2A



Existing Structures in the Project Alignment of PH-2A

- Flyover -3 no's
- Split Flyover-6 no's
- Under Pass- 3 no's
- Foot over Bridge- 8no's

GENERAL ALIGNMENT OF APL-PH.2B



Existing Structures in the Project Alignment of PH-2B

- Flyover -5 no's
- Split Flyover-4 no's
- Under Pass- 8 no's
- Foot over Bridge- 8 no's
- Vehicle Over pass- 1 no's

Salient Features of PH2A

PKG-1

- Construction of elevated structures (viaduct & stations) between Central Silk Board to Kodibeesanahalli :- **Package-1**
- Contractor: **M/s Afcons infrastructure Ltd.**
- Contract Value: Rs. 785.23 Crs
- Start Date :05.07.2021 Completion Date :31.12.2023

PKG-2

- Construction of elevated structures (viaduct & stations) between Kodibeesanahalli to K R Puram :- **Package-2**
- Contractor: **M/s Shankaranarayana Constructions Pvt. Ltd.**
- Contract Value: Rs. 623.55 Crs
- Start Date :28.06.2021 Completion Date :24.12.2023

➔ Construction of elevated structures (viaduct & stations) between . Kasturi Nagar to Kempapura :- **Package-1**

➔ Contractor: **M/s NCC Ltd.**

Contract Value: Rs. 739.04 Cr

➔ Start Date : 15.12.2021

Completion date of Civil works:15.06.2024

➔ Construction of elevated structures (viaduct & stations) between Kempapura to IAF Yelahanka:- **Package-2**

➔ Contractor: **M/s NCC Ltd.**

Contract Value: Rs. 747.99 Cr

➔ Start Date : 15.12.2021

Completion date of Civil works: 14.03.2024

➔ Construction of elevated structures (viaduct & stations) between IAF Yelahanka to KIA Terminal :- **Package-3**

➔ Contractor: **M/s NCC Ltd.**

Contract Value: Rs. 680.21 Cr

➔ Start Date : 15.12.2021

Completion date of Civil works : 14.03.2024

Salient Features of PH2A

Viaduct	Uom	Pkg-1	Pkg-2	Total
Length of Viaduct	Km	9.057	8.834	17.89
No of Piles	Nos	1862	1500	3362
No of Piers	Nos	332	312	644
Normal Pier	Nos	167	216	383
Cantilever Pier	Nos	51	12	63
Portal Pier	Nos	12	21	33
Split Flyover Portal Pier	Nos	97	47	144
Portal Pier R5/P3	Nos	5		5
R1A Portal Pier	Nos		16	16
Super Structure Spans	Spans	379	330	709
U-Girder	Spans	322	271	593
I-Girder	Spans	34	33	67
Composite-Girder	Spans	22	25	47
Open Web Girder	Spans	1	1	2
Stations				
Station Length	m	810	945	1755
Number of Stations	Nos	6	7	13
Stations Names	135 m Each	Central Silk Board	Kodibeesanahalli	
		HSR layout	Marathahalli	
		Agara lake	ISRO	
		Ibbulur	Doddanekundi	
		Bellandur	DRDO sports complex	
		Kadubesanahalli	Mahadevpura K R Puram	
No of Piles	Nos	576	672	1248
No of Piers	Nos	48	74	122
Station I Girder Concourse and Platform level	Spans	42	50	92

LOOPS & RAMPS		
Length of the Ramp	Km	3.24
Ramp-A	m	1105
Ramp - B	m	282
Ramp - C	m	489
Ramp - D	m	1136
Ramp - E	m	229
No of Piles	Nos	496
No of Piers	Nos	102
Normal Pier	Nos	77
Cantilever Pier	Nos	13
Monolithic Pier	Nos	5
Portal Pier	Nos	7
No of Spans	Spans	102
I-Girder	Spans	91
Composite-Girder	Spans	7
Solid Slab	Spans	4

Salient Features of PH2B

Viaduct	Uom	Pkg-1	Pkg-2	Pkg-3	Total
Length of Viaduct	Km	11.003	11.678	15.011	37.69
No of Piles	Nos	1984	2632	2020	6636
No of Piers	Nos	496	560	482	1538
Normal Pier	Nos	181	387	342 Pier + 3 (Abt)	913
Cantilever Pier	Nos	39	25	7	71
Portal Pier	Nos	114	77	118	309
Split Flyover Portal Pier	Nos	162	-	-	162
Portal Pier Link Line	Nos	10	-	-	10
Portal Pier	Nos	133	-	-	133
Depot Entry Line	Nos	-	-	11 Pier +1 (Abt)	12
Super Structure Spans	Spans	340	448	434	1222
U-Girder	Spans	546	375	391	1312
Steel U-Girder	Spans	-	-	3	3
I-Girder	Spans	248	152	30	430
Composite-Girder	Spans	19	11	8	38
Open Web Girder	Spans	2	-	2	4
At grade portion	Km	-	-	2815	2815
Cut & Cover	M	-	-	718	718
Stations					
Station Length	m	1104	675	135	1914
Number of Stations	Nos	8	5	1	14
Stations Names	135 m Each	Kasturi Nagar	Hebbal		
		Horamavu	Kodigehalli		
		HRBR Layout	Jakkur Cross		
		Kalyan Nagar	Yelahanka		
		HBR Layout	Bagalur Cross		
		Nagawara		Doddajala	
		Veerannapalya			
Kempapura					
No of Piles	Nos	546	454	96	1096
No of Piers	Nos	99	71	16	186
Station I Girder Concourse and Platform level	Spans	57	70	260	387

Sequence of Metro construction Work

- Barricading Stretch wise
- Pile foundation works
- Pile Caps
- Pier & Pier Caps
- Crash Barrier for Piers
- Launching of Girders
- Road Restoration works
- Stretch wise Removal of Barricades

Progress Details –PH-2A

VIADUCT			PH2A-P1		PH2A-P2		Total
Sl.No	Description	Unit	Scope	% Completion	Scope	% Completion	% Completion
1	Working Pile	Nos	1862	59%	1500	67%	62%
2	Pile Cap	Nos	339	29%	312	45%	37%
3	Pier	Nos	436	12%	312	31%	20%
4	U-Girder Casting	Nos	560	23%	444	32%	27%
5	U-Girder Erection	Nos	560	-	444	11%	5%
6	Pier Cap Casting	Nos	218	31%	228	52%	41%
7	Pier Cap Erection	Nos	218	10%	228	20%	15%
8	Split Flyover Tie Beams Casting	Nos	97	47%	47	36%	44%
9	Split Flyover Tie Beams Erection	Nos	97	10%	47	8%	9%
			Over all %	26%		32%	29%
STATIONS							
1	Working Pile	Nos	288	58%	480	63%	61%
2	Pile Cap	Nos	48	23%	74	36%	31%
3	Pier	Nos	48	13%	74	4%	8%
4	U-Girder Casting	Nos	84	38%	98	-	18%
			Over all %	13%		10%	12%
LOOPS AND RAMPS							
1	Working Pile	Nos	496	50%	-	-	50%
2	Pile Cap	Nos	109	35%	-	-	35%
3	Pier	Nos	109	27%	-	-	27%
4	I-Girder Casting	Nos	375	21%	-	-	21%
			Over all %	14%			14%

Progress Details –PH-2B

VIADUCT			PH2B-P1		PH2B-P2		PH2B-P3		Total
Sl.No	Description	Unit	Scope	% Completion	Scope	% Completion	Scope	% Completion	% Completion
1	Working Pile	Nos	1984	23%	2632	32%	1968	40%	32%
2	Pile Cap	Nos	361	15%	560	21%	473	27%	21%
3	Pier	Nos	496	4%	560	8%	473	13%	8%
4	U-Girder Casting	Nos	546	0.10%	726	0.10%	714	1%	0.4%
5	Pier Cap Casting	Nos	335	-	412	0.10%	317	2%	0.7%
			Overall %	4%		4%		9%	6%
STATIONS									
1	Working Pile	Nos	546	26%	454	40%	72	79%	48%
2	Pile Cap	Nos	99	2%	71	8%	12	25%	12%
			Overall %	1.50%		2%		3%	2%

TREE CUTTING & TRANSPLANTATION STATUS of PH2A

DESCRIPTION	Quantity in Nos		Completed		Balance
	PH-2A-P1	PH-2A-P2	PH-2A-P1	PH-2A-P2	
Number of Trees Affected	1007	1108		-	-
Number of Trees to be Cut	691	573	691	573	0
Number of Trees to be Transplant	268	512	238	487	55
Number of Trees retained	48	23	48	23	0

NOTE:-

- ❖ Official Memorandum for BBMP trees were issued on 26th Nov 21
- ❖ Tree clearance for BBMP trees by Hon'ble High Court were issued on 23rd Dec 21.
- ❖ Official Memorandum for Urban trees were issued on 09th Dec 21.
- ❖ Tree clearance for Urban trees by Hon'ble High Court were issued on 09th Feb 22.
- ❖ Preparation Period for Tree Transplantation will required minimum 3 months.

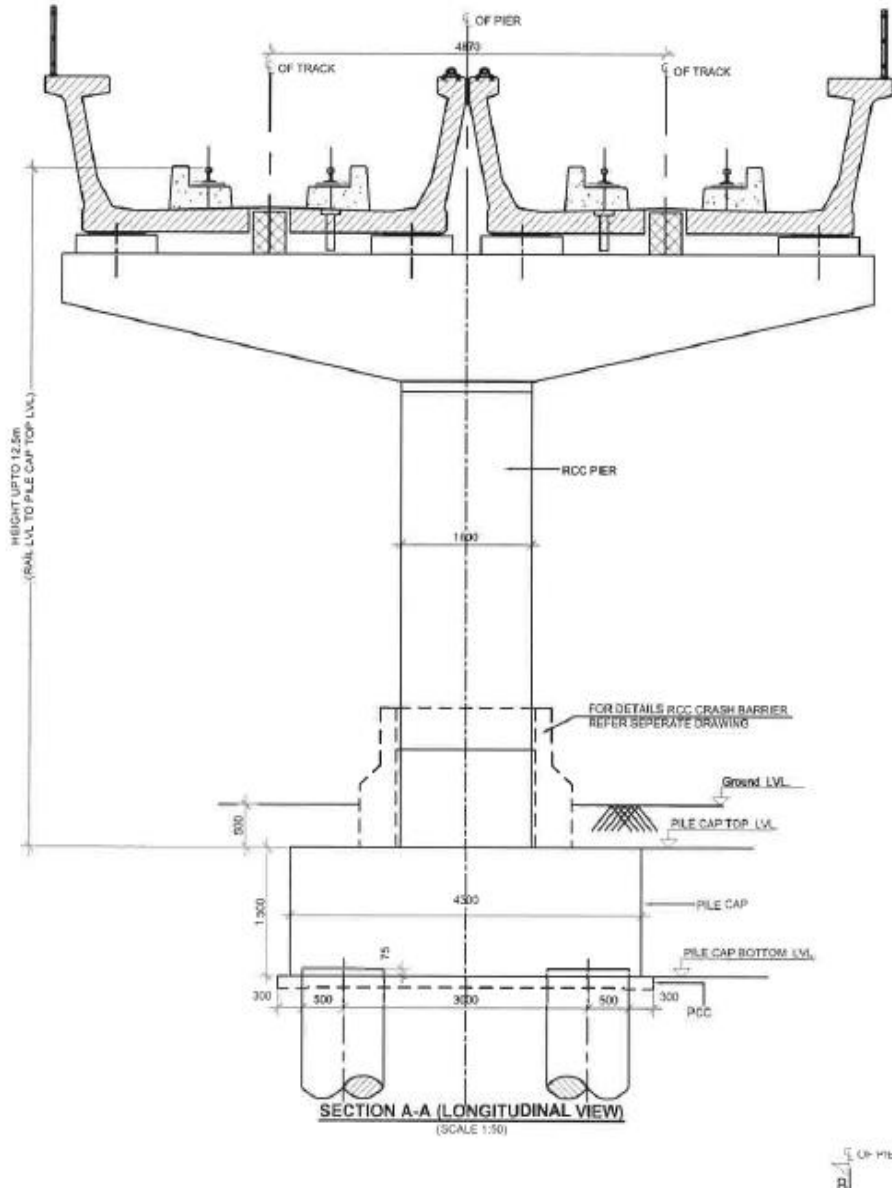
TREE CUTTING & TRANSPLANTATION STATUS of PH2B

DESCRIPTION	Quantity in Nos			Completed			Balance
	PH-2B-P1	PH-2B-P2	PH-2B-P3	PH-2B-P1	PH-2B-P2	PH-2B-P3	
Number of Trees Affected	1507	604	633	-	-	-	-
Number of Trees to be Cut	1334	547	618	1334	243	322	600
Number of Trees to be Transplant	160	39	11	22	39	-	188
Number of Trees retained	13	28	04	-	-	-	-

DESCRIPTION	Issued on		
	PH-2B-P1	PH-2B-P2	PH-2B-P3
Official Memorandum for BBMP trees	10.03.2022	26.07.2022	--
Tree clearance for BBMP trees by Hon'ble High Court	20.04.2022	29.09.2022	--
Tree clearance for BBMP trees by DCF Rural	--		21.10.2021
Official Memorandum for Urban trees	--	29.08.2022	29.08.2022
Tree clearance for Urban trees by Hon'ble High Court	Awaiting	Awaiting	Awaiting

**Important
Dates**

Advantages of U-Girder Construction

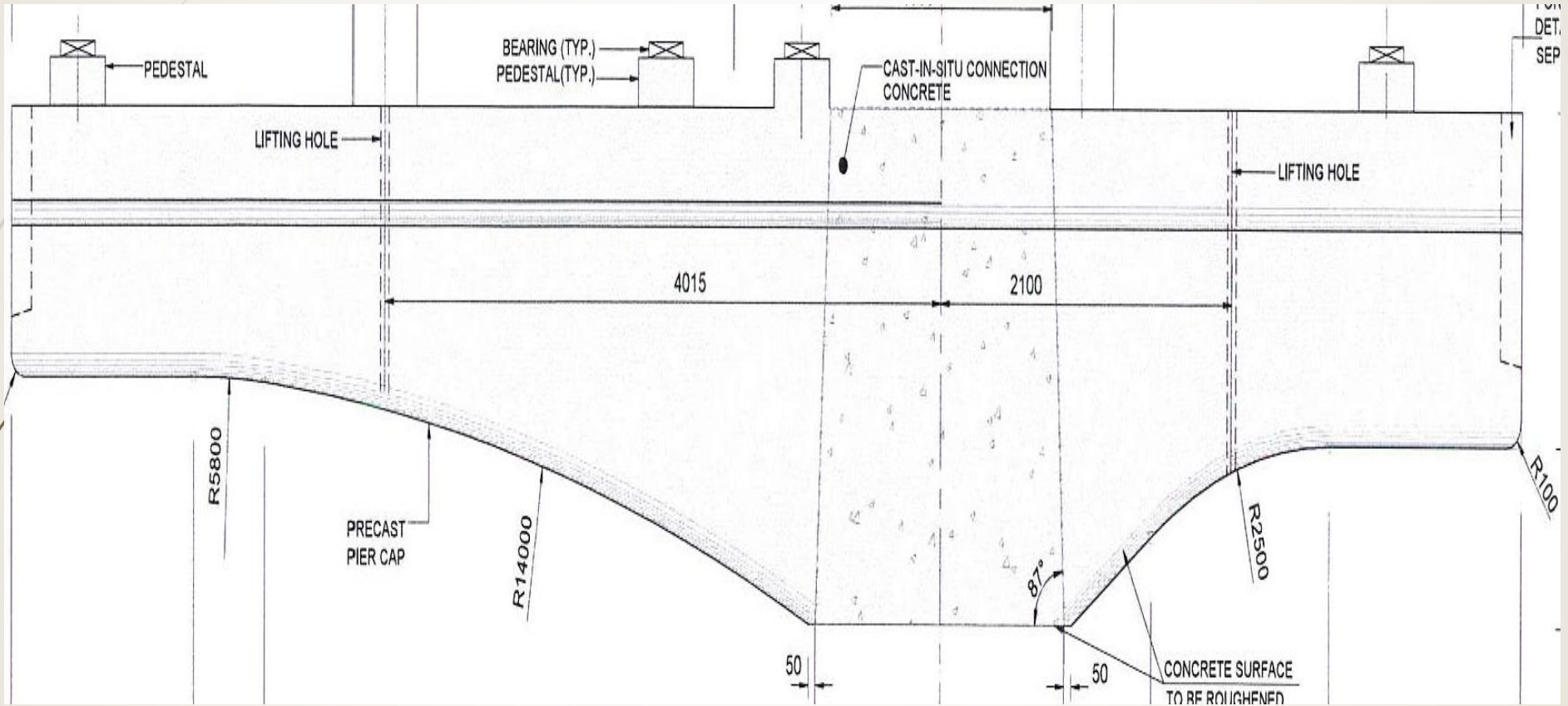


- ❖ Superstructure with U Girder method of construction is adopted in Ph-2A & 2B .
- ❖ Two girders will be erected for each span to cater for two tracks.
- ❖ U Girders are Pre tensioned Pre cast.
- ❖ Speed of construction of Superstructure becomes faster compared to the segmental construction.
- ❖ U girders can be used up to 28 mtr span which weights around 176 M.Ton
- ❖ U girders are more economical

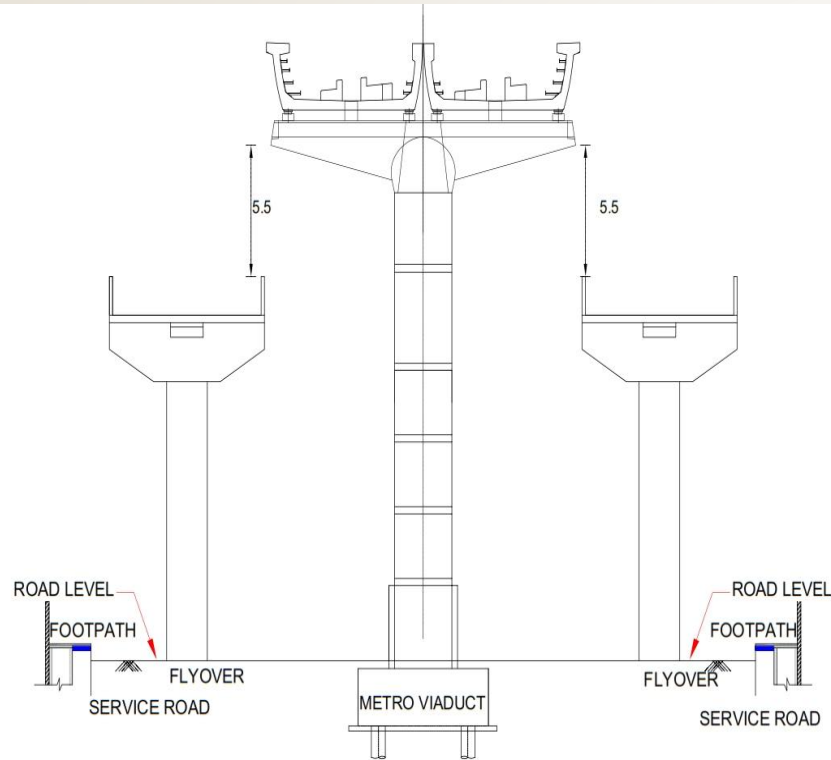
Innovations Adopted in PH 2A &2B for fast track construction

- ❖ During design stage, many elements of viaduct and stations were explored for pre-cast items which in turn facilitated for fast –track construction.
- ❖ Eccentric Pier Cap: **Cast-In-Situ to Precast.**
- ❖ **Portal Piers with precast beams** in Split flyover
- ❖ Station Pier arm at Concourse and Platform Lvl: **Cast-In-Situ to Precast**
- ❖ **Precast I-girders** for Concourse and Platform Lvl for stations
- ❖ **Walkway below the viaduct** is proposed to facilitate Commuters/Pedestrians for entry to stations/ crossing the road.

Eccentric Pier Cap -Precast

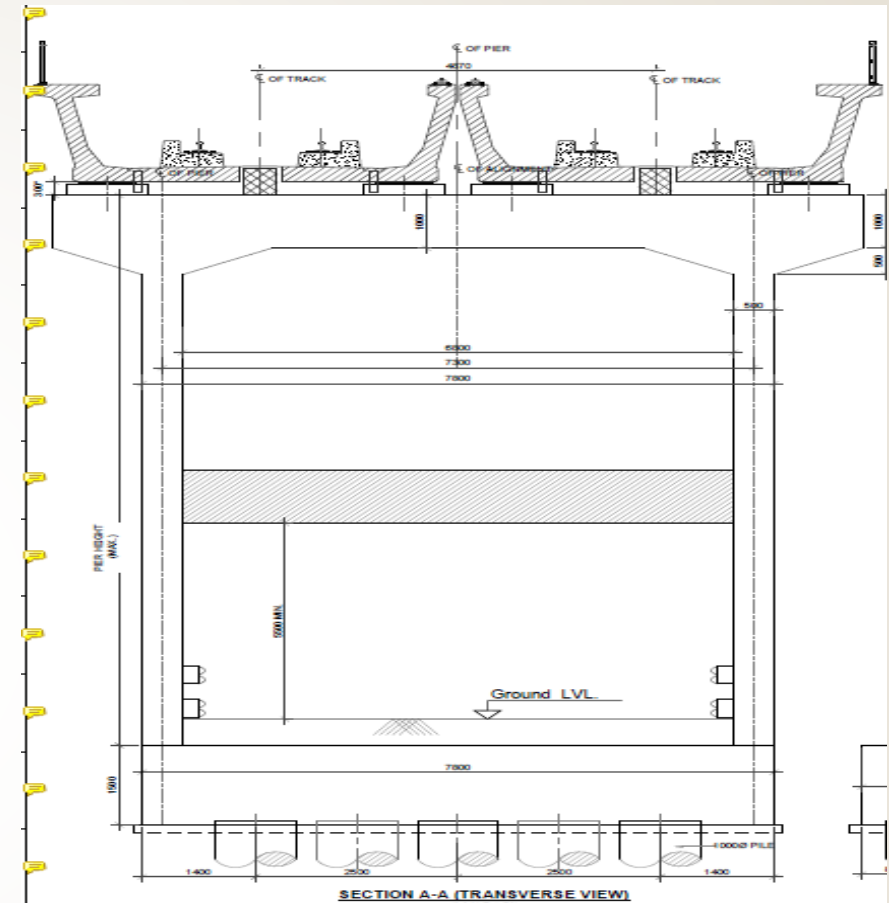


Portal Pier in Split Flyover



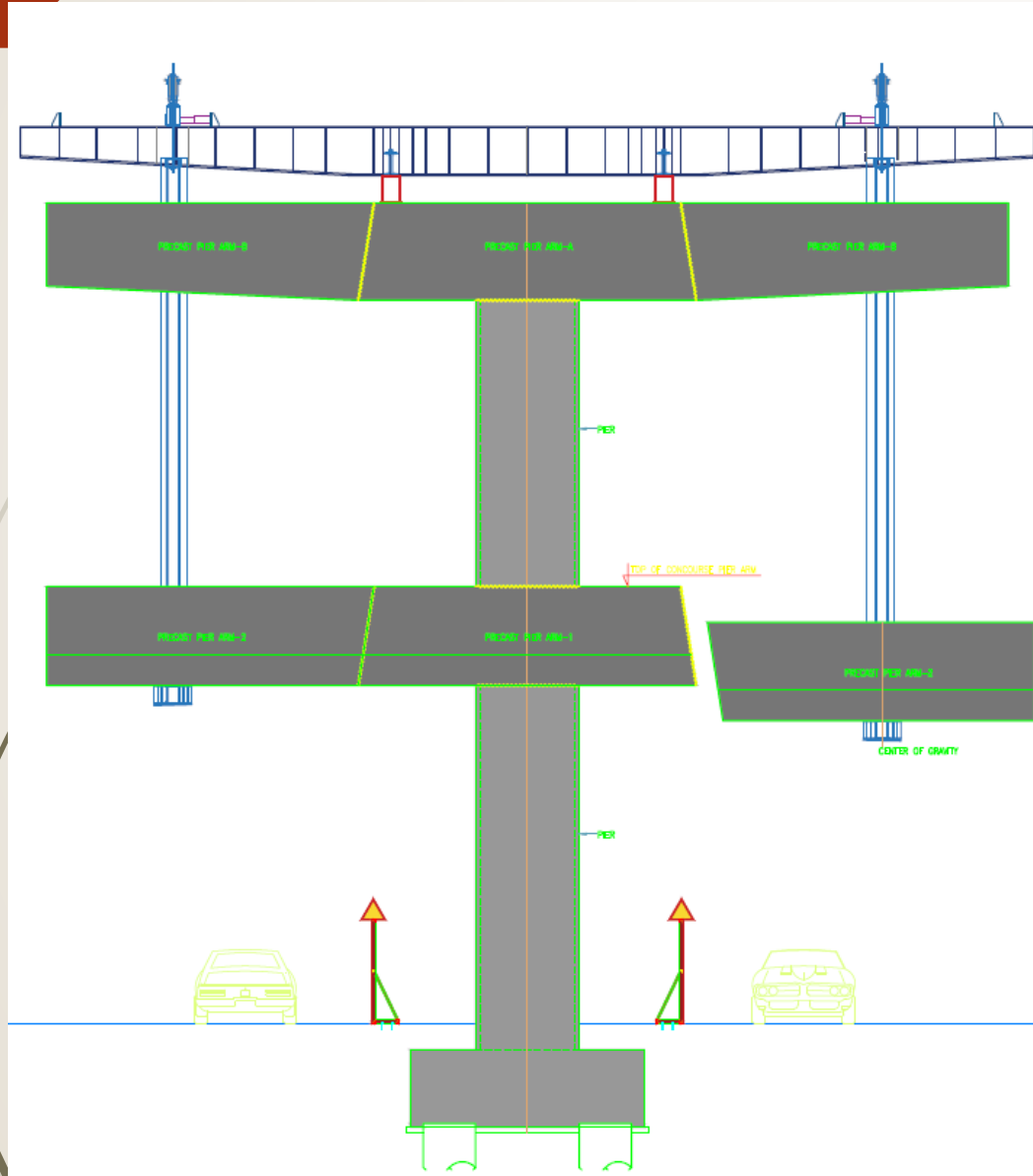
TYPICAL CROSS-SECTION AT VIADUCT PART OF SPLIT FLYOVER

- ❖ Initially, piers between split flyover were planned with concentric pier and the clear width available after construction was expected only 2.80 m on either side.
- ❖ Road with lane width less than 3.75m is not feasible for mixed traffic.



- ❖ 135 nos of Portal pier proposed in between split flyover.
 - ❖ Due to this modification additional cost incurred around **70 cr**
- Advantages:**
- ❖ Clear road width available after construction will be more than 5m.
 - ❖ Caters for mixed traffic and at grade road can be used optimally.

Station Pier arm at Concourse and Platform Level



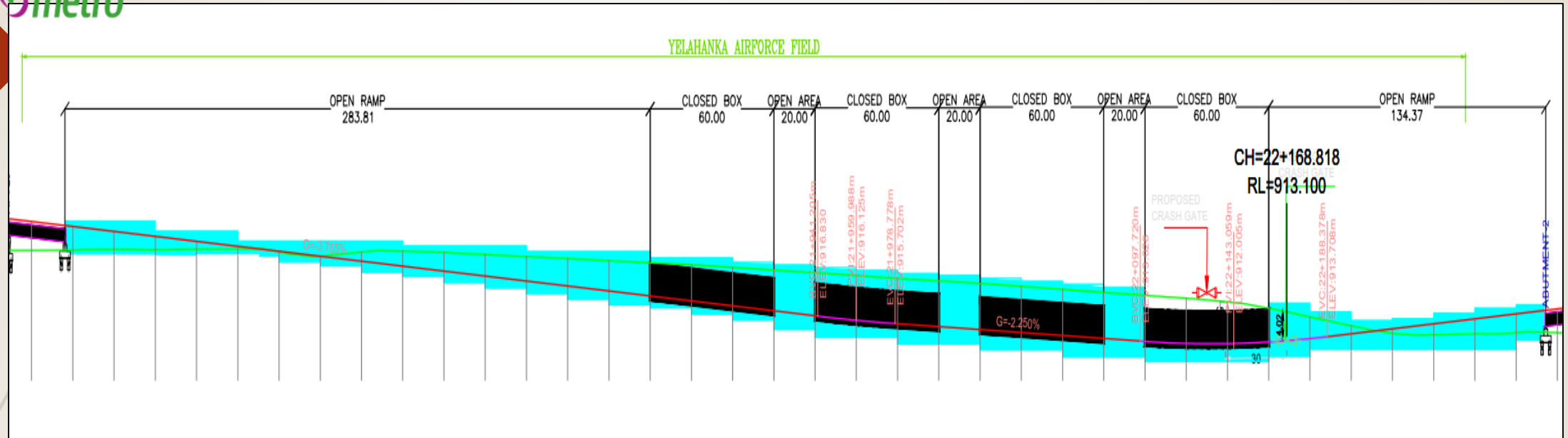
Cut and Cover Portion near IAF Yelahanka



Salient Features of Present Alignment

- Ramp down starts at – Ch:21+576 (with length of ramp 284 m)
- Closed box and Open Box – Ch:21+860 (with total length 300 m)
 - 4 closed boxes of 60 m each
 - Each closed box separated by open box of 20 m each (3 nos.)
- Ramp up starts at – Ch: 22+160 (with length of ramp 134 m)

L - Section of Cut and Cover Portion in IAF Yelahanka area



- **Open ramp**
 - Length - 283.81 m (towards Hebbal)
 - 134.37 m (towards KIA)
- **Closed Box**
 - Number of closed boxes - 4
 - Length of each closed box - 60 m
 - Total length of closed boxes - 240 m
- **Open to sky (between boxes)**
 - Number of open to sky - 3
 - Length of open to sky section - 20 m
 - Total length of open to sky section - 60 m

Launching Scheme

Two methods of Launching Scheme adopted for erection of U -Girder

- ❖ 1.Erection of U Girder by using cranes (2 nos)
- ❖ 2.Erection of U Girder by using Launching Girder

1. Erection of U-Girder by using Cranes (2 nos)



2. Erection of U Girder by using Launching Girder



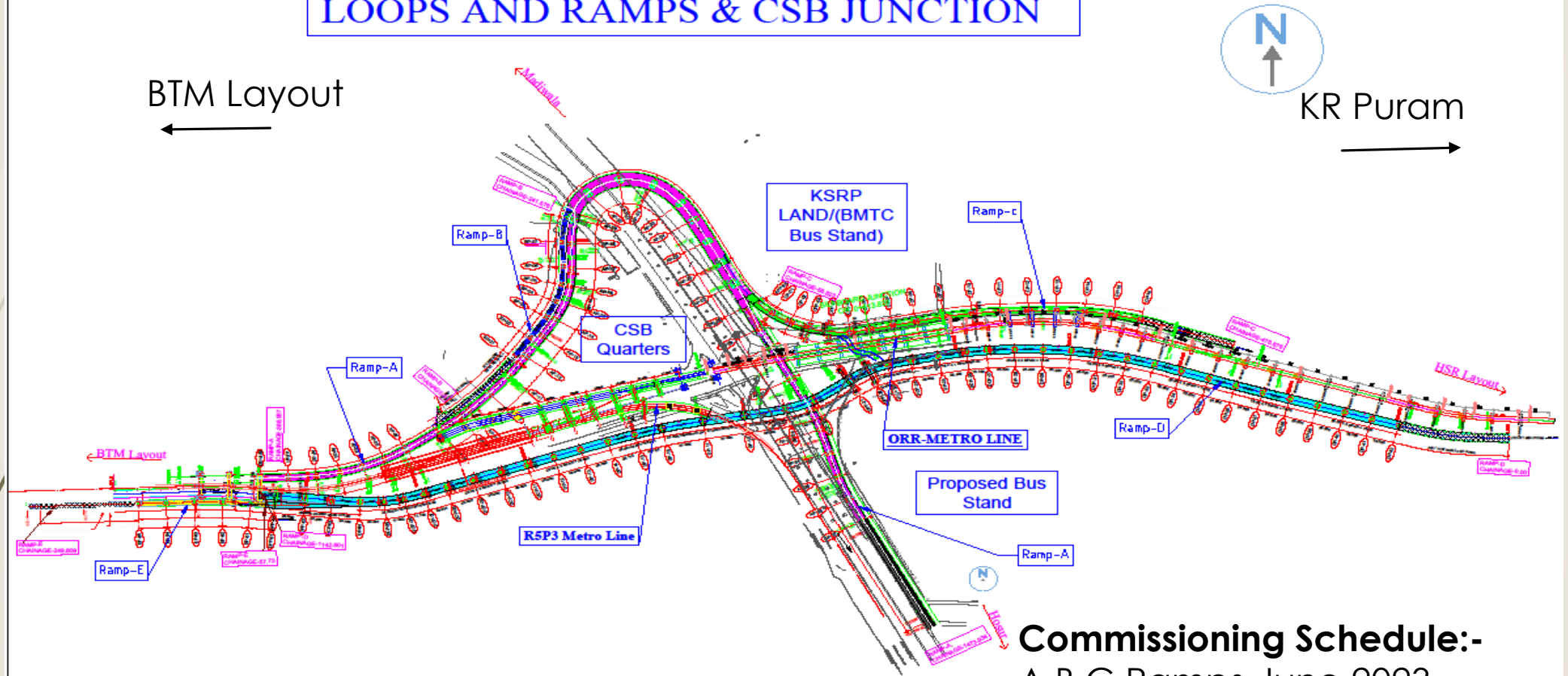
Please click
for video

Multimodal Transit Integration (MMI)

Central Silk Board –Major Integration Junction

Elevated connectivity between Ph-2 and Ph-2A stns and Bus stand on either side of the Road.

LOOPS AND RAMPS & CSB JUNCTION



Commissioning Schedule:-

A,B,C Ramps-June 2023

D & E ramp-Dec 2023

Walk way Provision below Viaduct



- ❖ Metro Stations are facilitating as skywalks/FoB and Pedestrians can use the stations for crossing the road.
- ❖ To integrate the Commercial and Office spaces with the Metro Stations, it is proposed to construct elevated walkways below the viaduct between the Stations on PPP model.
- ❖ Walkway below the viaduct is proposed from Ibbalur station to Kodibesanahalli station & ISRO station to Saraswathi nagar station
- ❖ Walkway construction to give direct access can be taken up simultaneously if any corporates are interested

Walk way Provision

← TO SILK BOARD

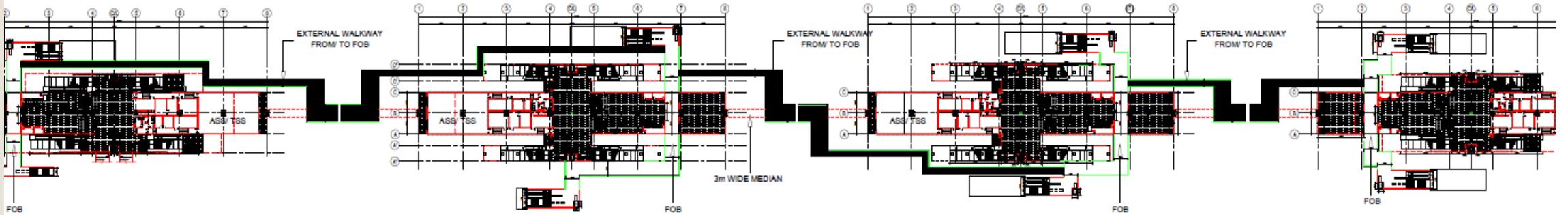
TO K.R.PURAM →

IBBALUR STATION

BELLANDUR STATION

KADUBEESANAHALLI STATION

KODIBEESANAHALLI STATION



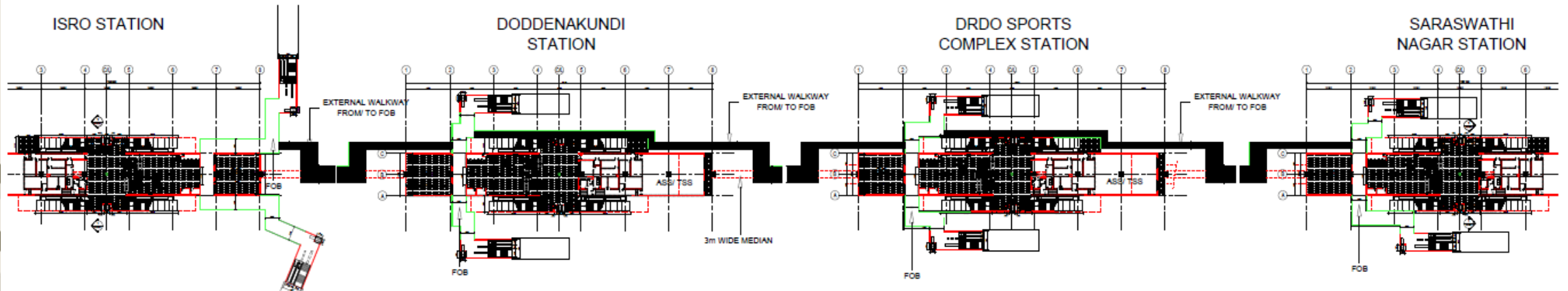
1 WALKWAY PROPOSAL - IBBILUR TO KODIBEESANAHALLI
SCALE: 1:5

ISRO STATION

DODDENAKUNDI STATION

DRDO SPORTS COMPLEX STATION

SARASWATHI NAGAR STATION



2 WALKWAY PROPOSAL-ISRO TO SARASWATI NAGAR
SCALE: 1:5

Median Garden

Landscaping being developed below the Viaduct as medians by collaborating with corporates under CSR activity.



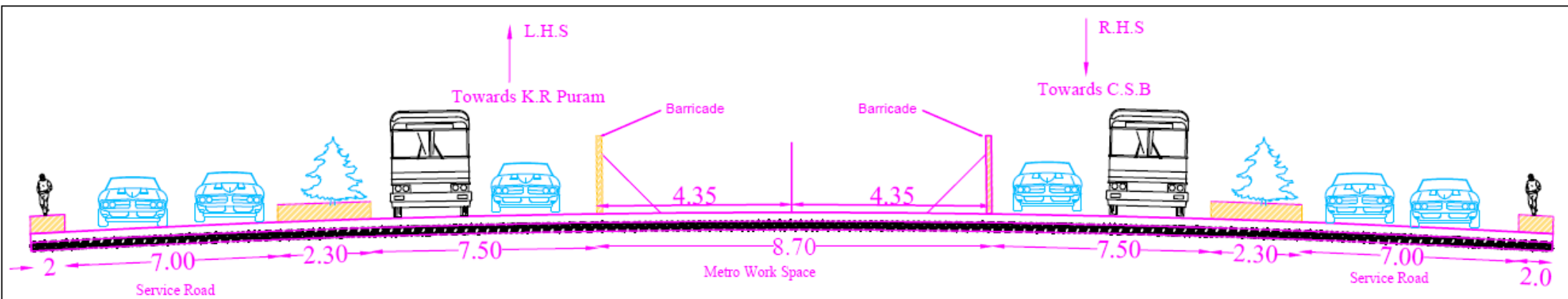
Pillars Painting

Column/Pillars are being Painted under CSR activity.

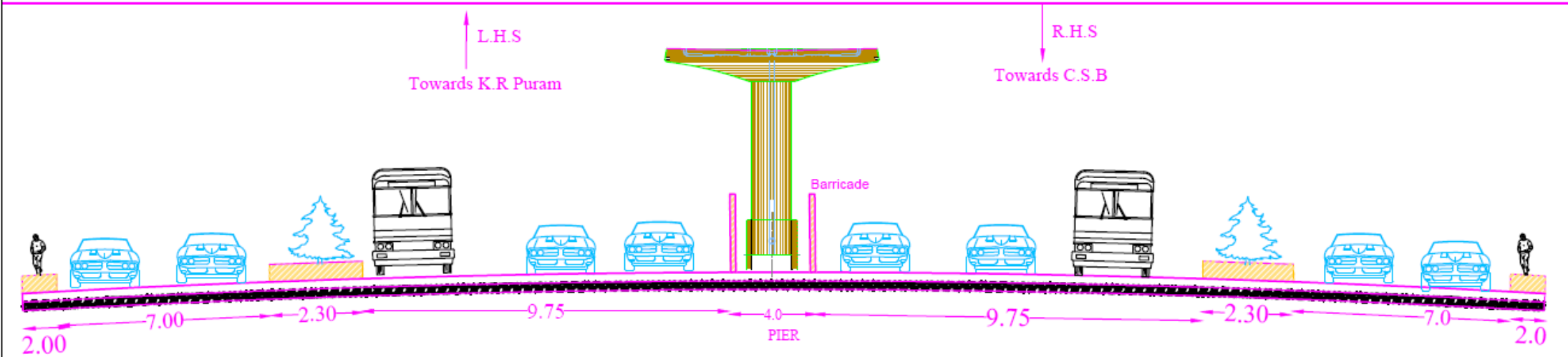
Pillars Paintings



Viaduct Road Restoration-PH2A

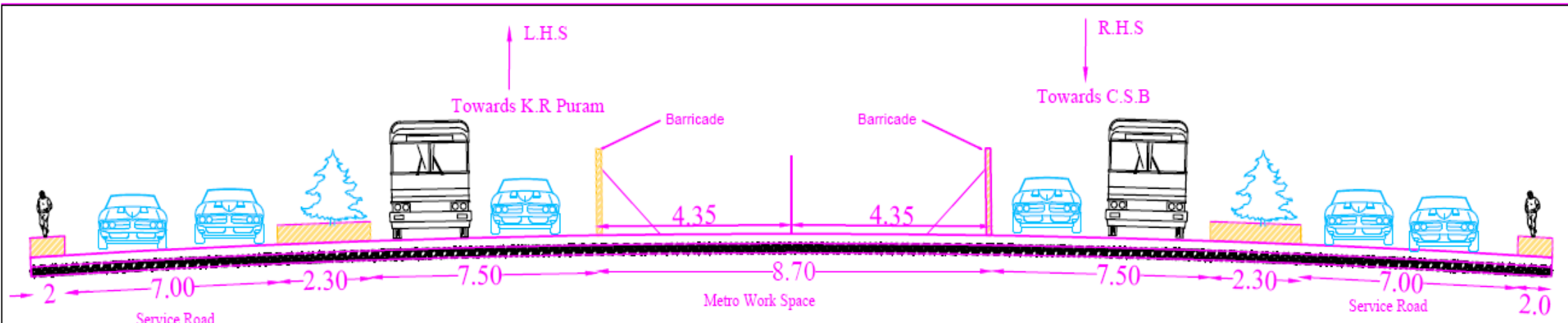


Stage 1 - Barricades & Vehicle movement during Construction

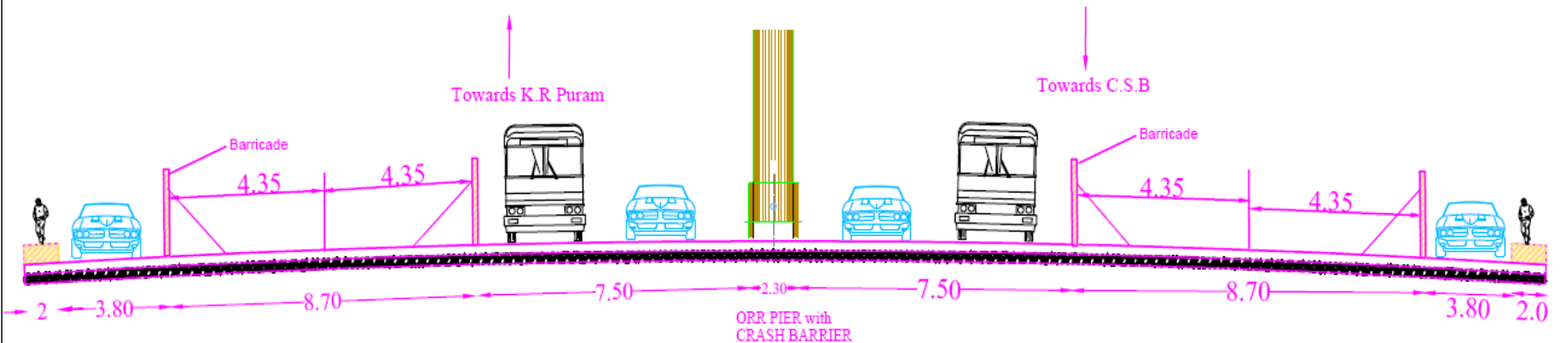


Stage 2 - Barricades & Vehicle movement after Pier Cap erection

Station Road Restoration-PH2A

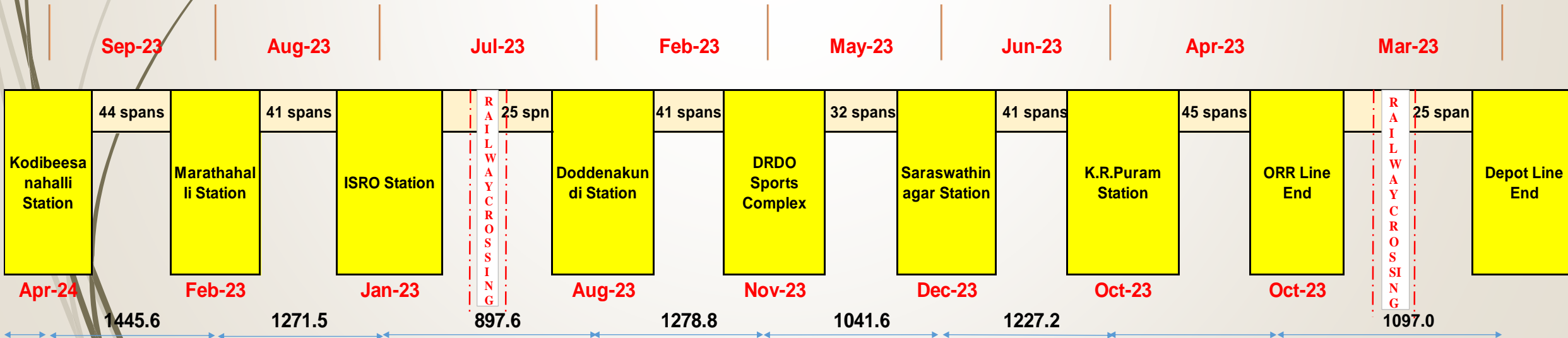
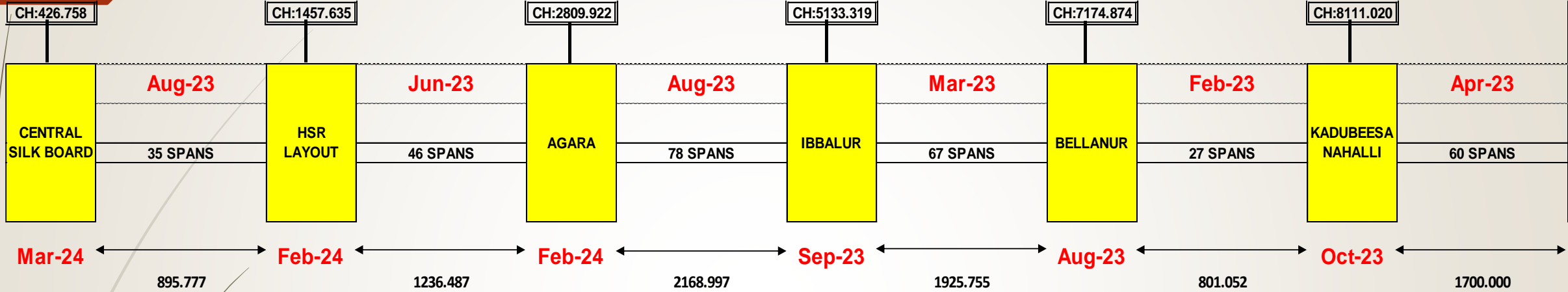


Stage 1 - Barricades & Vehicle movement during Central Pier Construction

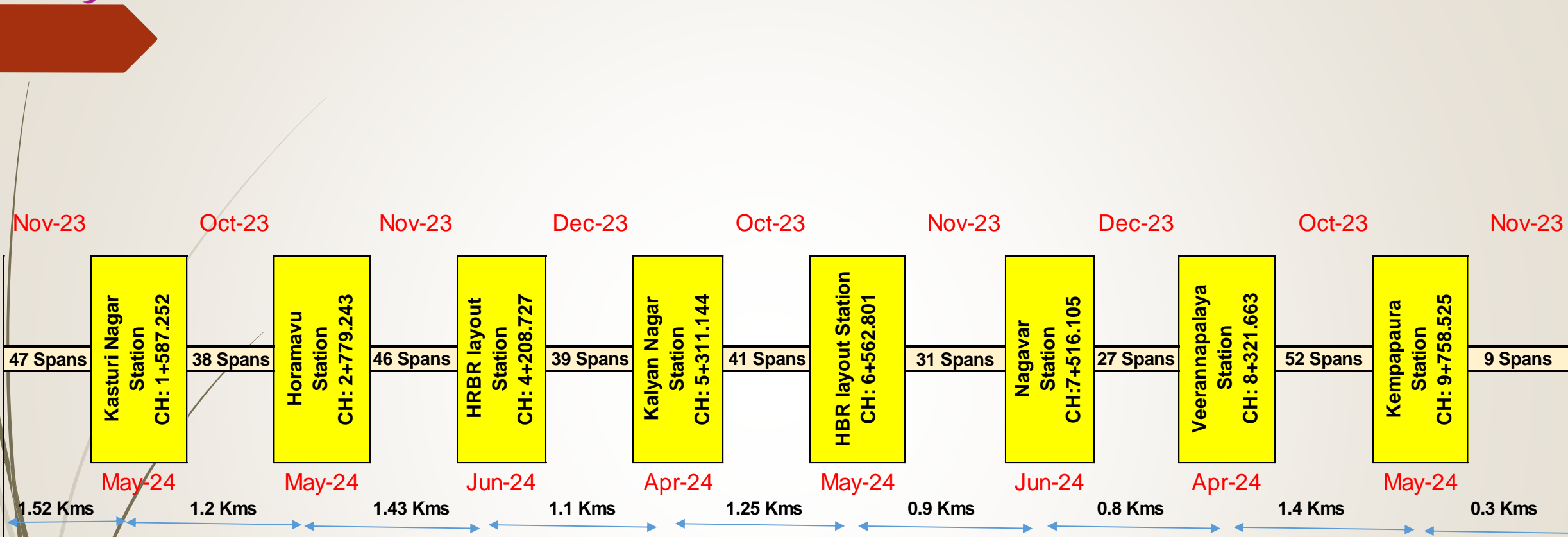


Stage 2-Barricades & Vehicle movement during secondary wing Construction

Road Restoration-PH2A



Road Restoration-PH2B



Progress Photograph –PH 2A

Precast Pier Cap Erected at Ibbalur



U Girder & I Girder at Casting yard



Erection of EOT gantry for feeding of U-Girder to LG



Pier caps Erection Completed from ORP 522 to ORP 527



U Girder erection ORP473-474



U Girder erection completed ORP473-474



Bird view of Casting yard



Progress Photograph –PH2B

Pier Concreting Work



Casting Yard



Casting of Piers



Casting & Stacking of Pier cap



Casting & Curing of U-Girders





THANK YOU

