Extract of the Report on Capacity Augmentation of Road and Rail infrastructure at Hebbal Junction prepared by Ms RITES.

The GoK and BMRCL engaged M/s RITES Ltd for conducting a comprehensive study and prepare a master plan for capacity augmentation at Hebbal junction to meet the estimated road traffic requirement of 2051 and integration of other modes of transport like Metro and suburban Lines.

The Extract of the report prepared by Ms RITES are presented in further pages. The Executive summary of the report is presented below. People can share their Views or opinion through email of PRO, BMRCL. (chavan@bmrc.co.in) within 15 days of this notification.

1. BMRCL has been constructing Phase 2A & 2B, ORR Airport Metro from Central Silk Board to Kempegowda International Airport via Hebbal junction. BMRCL has also been preparing DPR for construction of Metro corridor from Hebbal to JP Nagar along the ORR as Phase-3 completing the circular Metro on ORR

2. BDA has taken up construction of additional bridge at Hebbal junction on Airport to City direction in a curved shape and going to level-2 over the ground level. it is found that this structure will pose serious hindrance for future development of further infrastructure at Hebbal Junction. It also obstructs Phase-3 Metro corridor.

3. RITES interacted with various agencies like BDA, BBMP, BESCOM, BWSSB, BMTC, K-RIDE, BMRCL and prepared various options to meet the traffic requirements in 2051. The options were discussed in the joint meetings and the most suitable option is finalised. The proposal is enclosed as Slides.

4. This proposal envisages**:**

   (i) Construction of additional 2 lane flyover to the west of existing flyover making it 5 lane movement from City to Airport.
   (ii) On the eastern side, 3 lane fly over will be constructed in addition to the existing 2 lane making it 5 lane movement from Airport to the City.
   (iii) With the above Both **to and from** Airport will have 5 Lanes.
   (iv) Existing elevated loop from City to Tumkur will have to be rebuilt after the new lanes are added.
   (v) Existing elevated loop from City to KR Puram will be retained.
   (vi) Existing elevated connection from KR Puram to city will have to be rebuilt after the new 2 lanes are added.
   (vii) Tumkur to City, loop will be removed to make this space available for Multimodal Integration and BMTC bus stop. Vehicles will run further and take a U turn through underpass and travel to the City over the loop of KR Puram to City.

(viii) BDA has already planned for construction of 3 lanes under pass (for Tumkur to KR Puram traffic) This will continue.

(ix) KR Puram to Airport, 2 lane elevated flyover as planned by BDA will be provided with modified Geometry.

(x) KR Puram to Tumkur: Existing straight road is widened to 4 lane Road.

.

5. Details of the existing road capacity and after implementation of the proposal will be as follows:

Sl No	Traffic movements	Existing no. of lanes	Proposed no.of lanes	Remarks
1.	City to Airport	3	5	Flyover (Existing 2 lanes + 3 additional lanes Proposed)
2.	City to Tumkur	1.5	2	Flyover (Existing1.5 Lanes to be dismantled & additional 2 lanes are proposed)
3.	City to KR Puram	1.5	1.5	Flyover(existing loop retained)
4.	Airport to city	2	5	Flyover (Existing 2 lanes + 3 additional lanes are Proposed)
5.	Airport to Tumkur	2	4	At grade
6.	Airport to KR puram	2	3	At grade
7.	Tumkur to City	2	Nil	Existing loop to be dismantled. An under pass for U turn to be built.
8.	Tumkur to Airport	2	2	At grade
9.	Tumkur to KR Puram	3	3	Existing at grade road to be replaced by Underpass
10.	KR Puram to City	1.5	2	Flyover (Existing 1.5 lanes to be dismantled & 2 additional Lanes proposed)
11.	KR Puram to Tumkur	3	4	At grade
12.	KR Puram to Airport	3	2	Existing at grade to be replaced by fly over (2 additional Lanes Proposed)

6. Area of land required for this proposal is estimated as 33,558 Sqm. (23,118 Sqm of government land and 10,440 sqm of private land).

7. Piers of the new flyover coming up on the western side will be located over the bund of Hebbal lake. After construction of the piers, lake bund will be brought back to the original condition and hence piers will not cause any additional constriction to the water body.

Details are presented in further pages.

Bangalore Metro Rail Corporation Limited

BANGALORE METRO RAIL CORPORATION LIMITED

(A Joint Venture of Government of India and Government of Karnataka)

STUDY OF CAPACITY AUGMENTATION & MMI HUB AT HEBBAL JUNCTION, BANGALORE

15th DECEMBER 2021

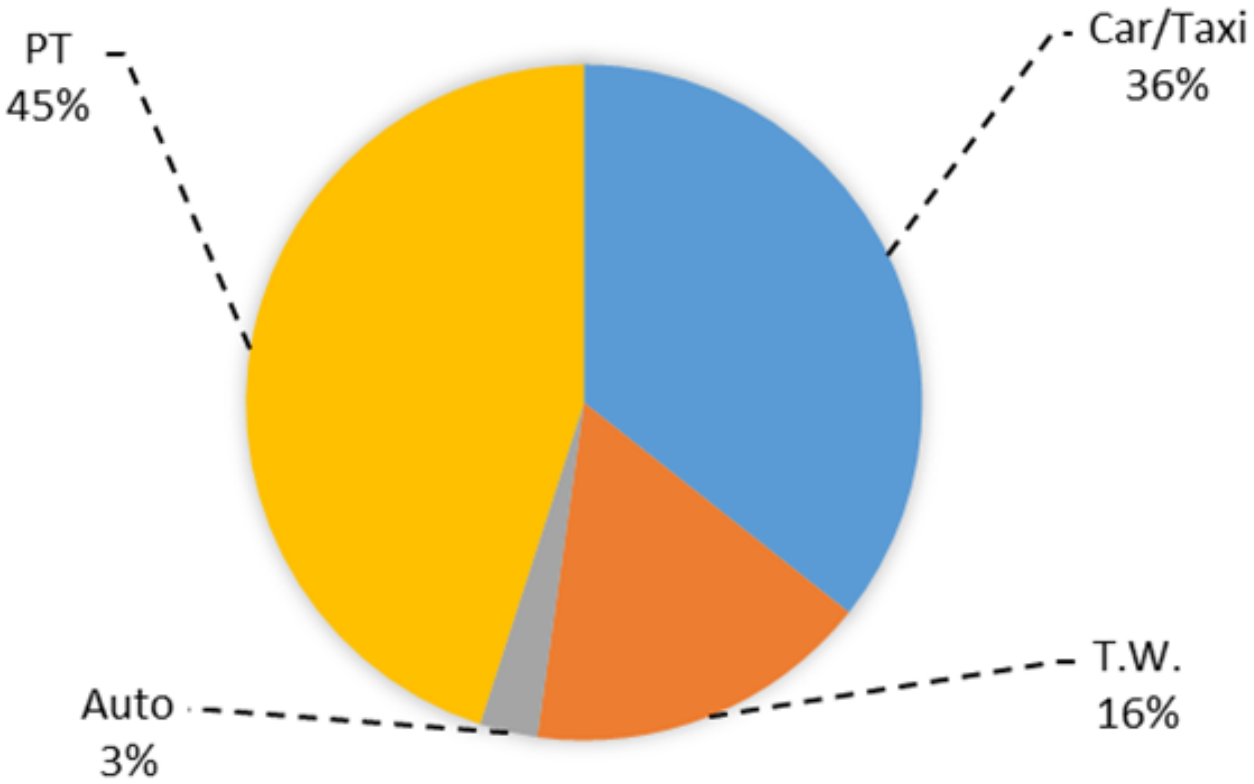
RITES
THE INFRASTRUCTURE PEOPLE
A Government of India Enterprise

STUDY LOCATION - HEBBAL JUNCTION

VARIOUS INFRASTRUCTURE PROPOSALS

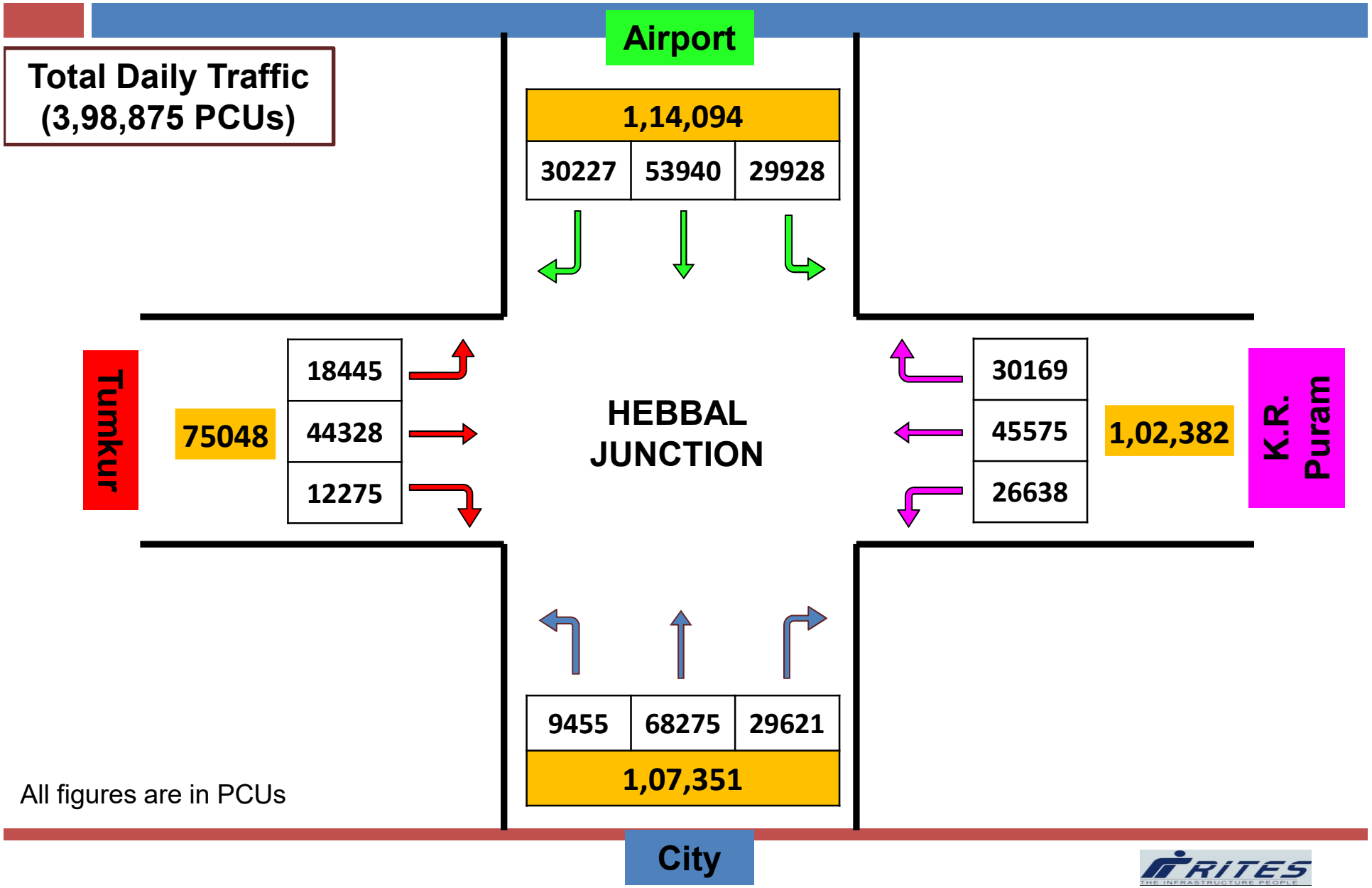
- Many Infrastructure Proposals at Hebbal Junction
  - BMRCL (Phase 2B) - Metro Rail Project between KR Puram and Kempegowda International Airport via Hebbal along ORR and NH-44
  - BMRCL (Phase 3) - Proposed Metro Rail Corridor JP Nagar to Hebbal
  - BDA
    - Under construction Flyover from KR Puram to Airport
    - Under construction Flyover from Airport to Baptist Hospital
    - Proposed Underpass below existing flyover along ORR (Tumkur Road to KR Puram)
  - KRDCL – Proposed North-South Elevated Road corridor
  - SWR - Doubling of existing railway track by K-RIDE
  - K-RIDE – Bangalore Suburban Rail Project (BSRP)

MODAL SPLIT AT HEBBAL JUNCTION (2019)



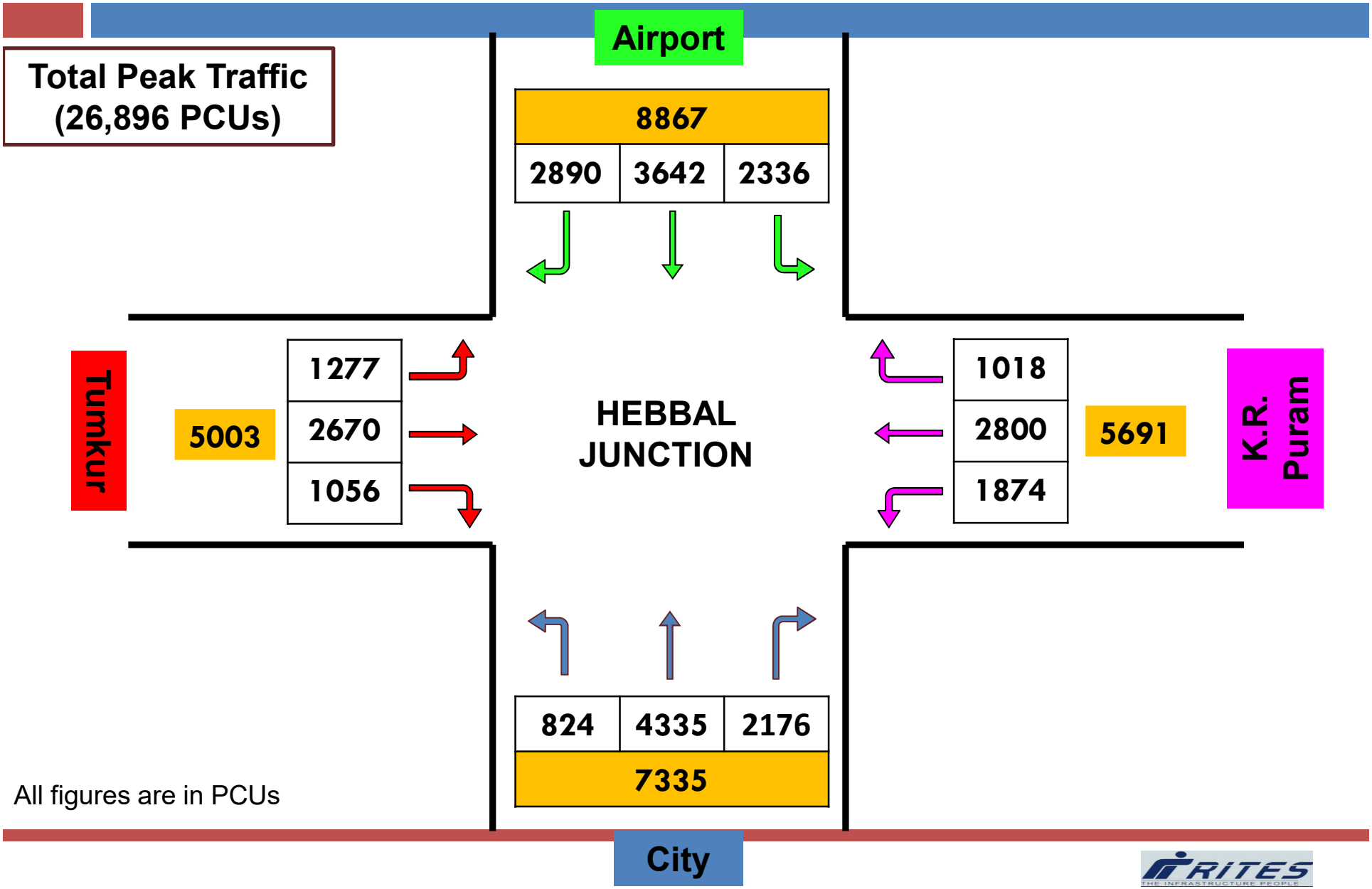
July'2019 Daily Traffic (3,98,875 PCUs)

DAILY TRAFFIC – 2019 (HEBBAL)



All figures are in PCUs

PEAK HOUR TRAFFIC – 2019 (HEBBAL)



All figures are in PCUs

TRAFFIC DEMAND FORECAST

Traffic scenarios :

1. **Business As Usual (BAU) Scenario**
   - **Modal Split 45: 55 (PbT : PvT)**
2. **Public Transport (PT) Scenarios**
   - **PT Scenario 1 - Modal Split 60: 40 (PbT : PvT)**
   - **PT Scenario 2 - Modal Split 65: 35 (PbT : PvT)**

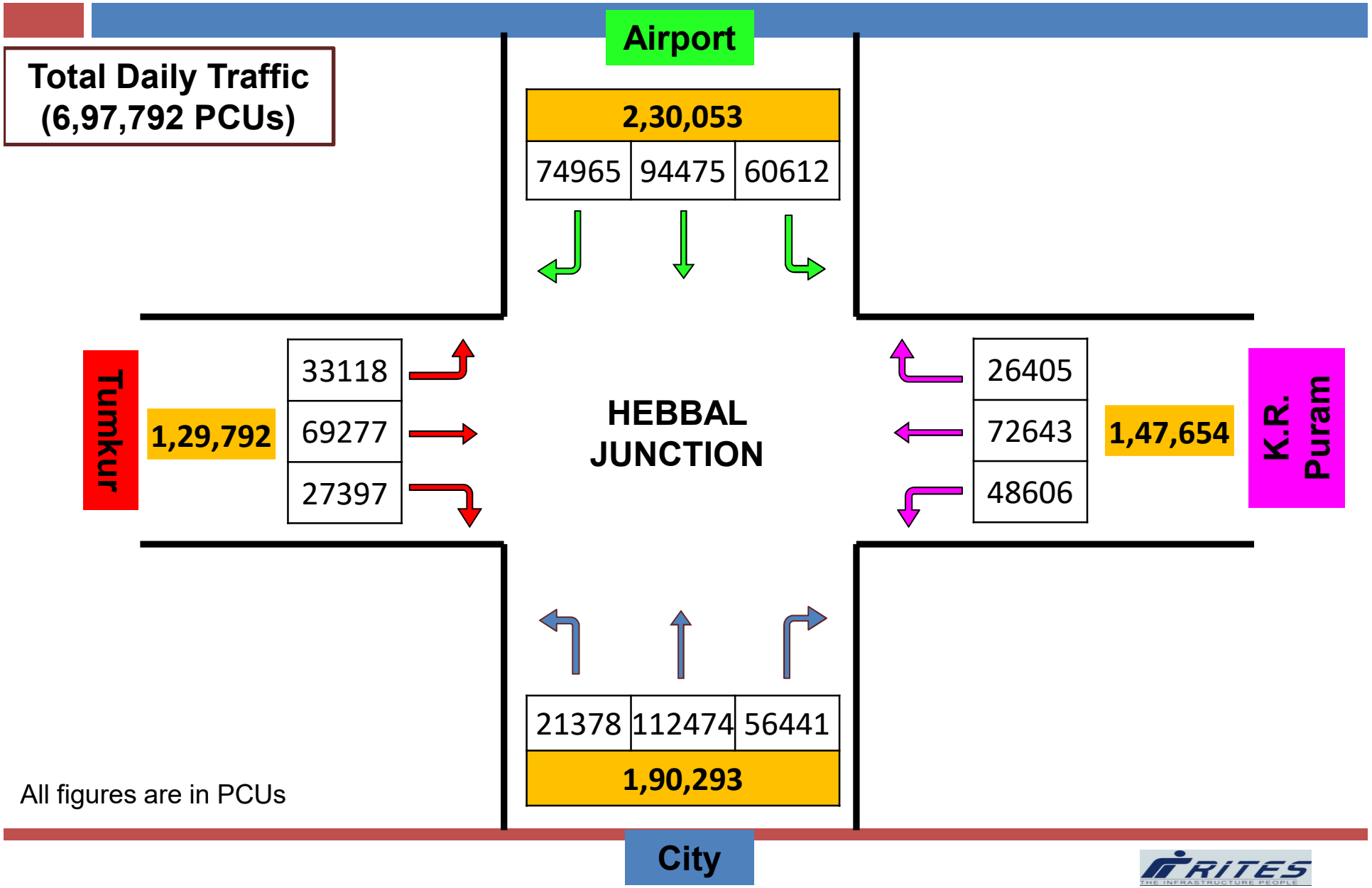
(PbT - Public Transport ; PvT- Private Transport)

TRAFFIC DEMAND AT HEBBAL

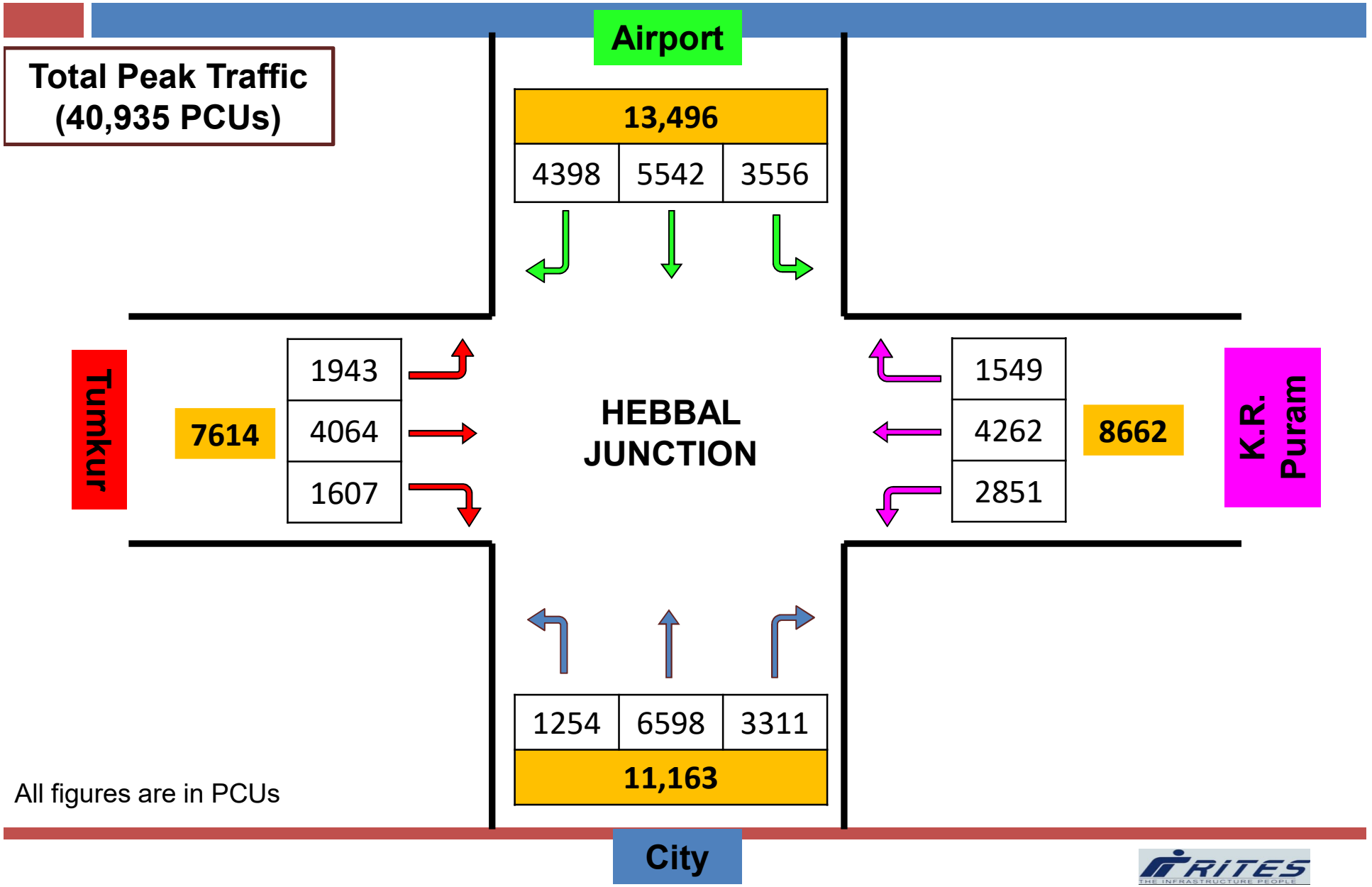
Year	Peak Hour		
	BAU Scenario	PT Scenario 1	PT Scenario 2*
2019	**26896**	**26896**	**26896**
2031	40396	32316	29556
2041	48209	38565	35272
2051	**55948**	**44757**	**40935**

PT Scenario is the recommended scenario

PT SCENARIO 2- DAILY TRAFFIC - 2051

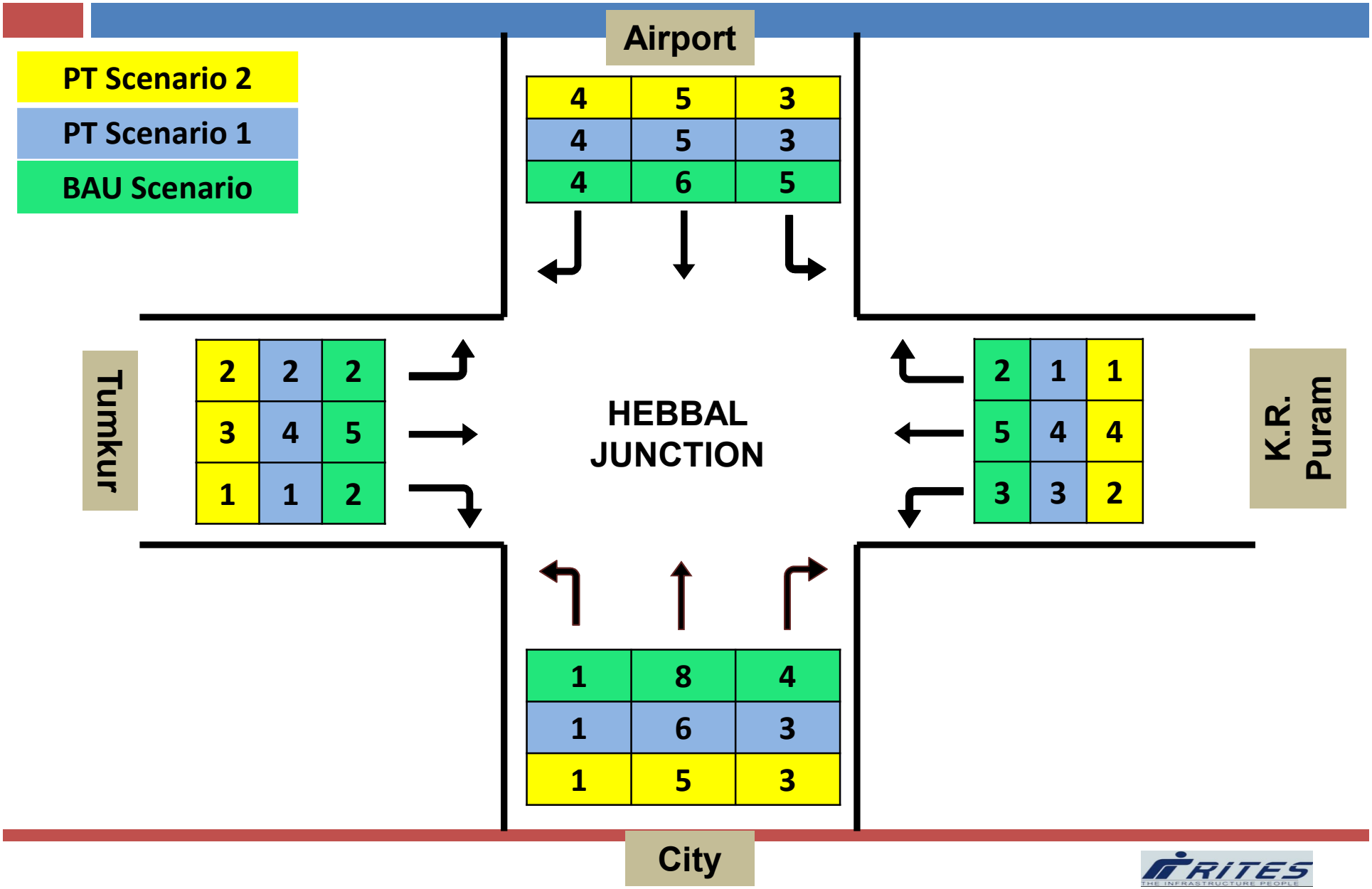


PT SCENARIO 2- PEAK HOUR TRAFFIC - 2051



All figures are in PCUs

LANE REQUIREMENT IN 2051



STUDY PROGRESS

- BMRCL has engaged RITES for the "Study of Capacity Augmentation of Hebbal Junction at Bangalore" vide their LOA No. BMRCL/ED-3/AP-line/2018-19/10001 dated 08.03.2019
- Interim Report was submitted in Aug'2019.
- Four proposals (Proposals 1, 1A, 2 and 2A) were presented in the Revised Interim Report (Oct'2019) and Proposal 2A was recommended.
- During the meeting held with BMRCL on 31.10.2019, RITES was advised to prepare another proposal namely Proposal 3 by eliminating the existing loops.
- Accordingly, details of Proposal 2A and Proposal 3 were presented in the draft Feasibility Report (Dec'2019).

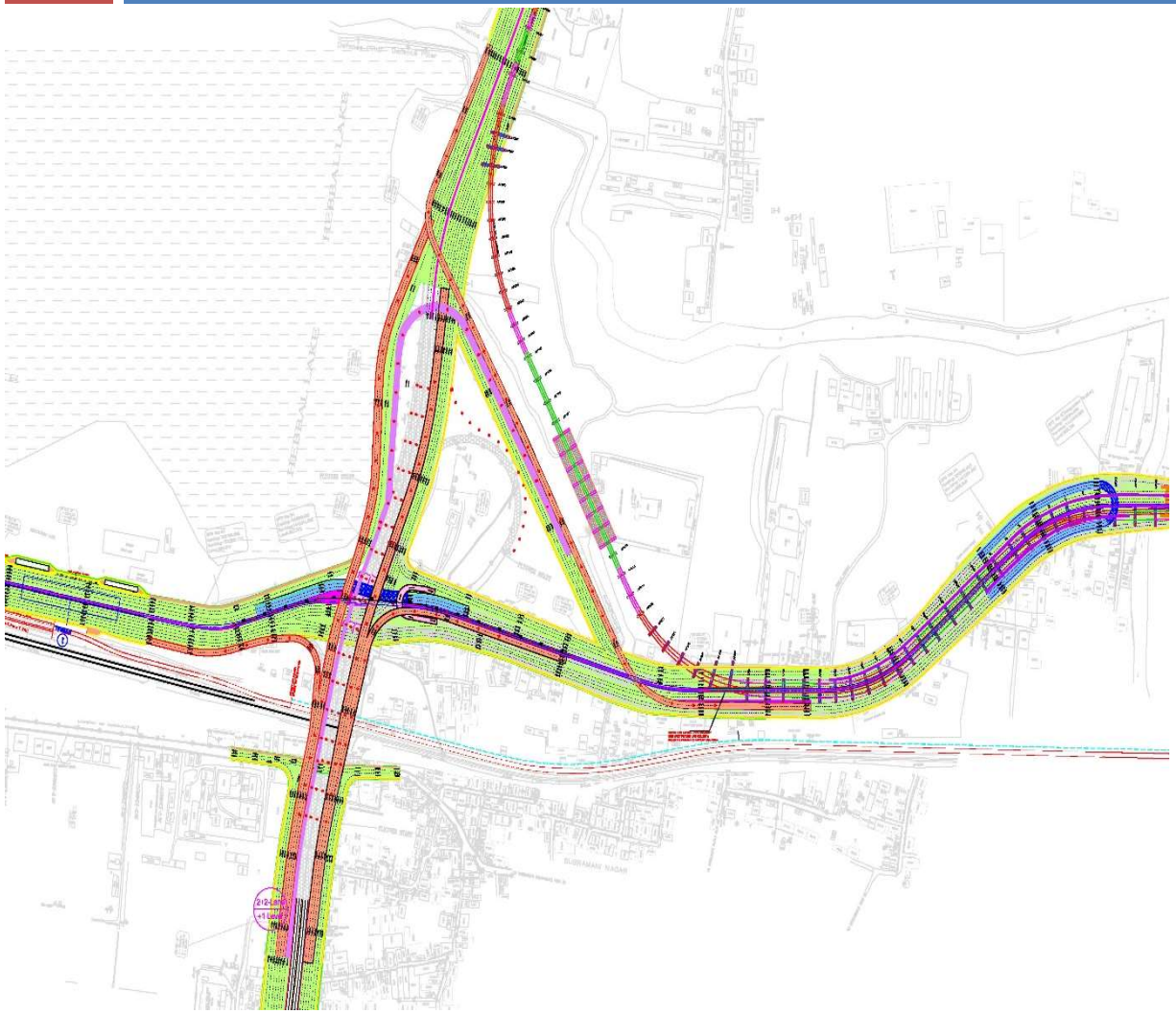
STUDY PROGRESS

- During the meeting chaired by Chief Secretary, GOK on 5th February'2020 with BMRCL and all other stake holders, a Technical committee with all the engineering head from BMRCL, PWD, RITES, KRDCL, BDA, traffic, DULT and BBMP with chairman as Secretary/PWD, GOK was constituted.
- Secretary/PWD chaired three meeting 10th, 17th and 25th February 2020 to finalize the proposals duly discussing with all the stake holders.
- Accordingly, two proposals i.e. Proposal 4 and Proposal 5 have been worked out based on the discussions.
- Proposals were prepared considering the existing flyover loops of City to Tumkur, Tumkur to City and KR Puram to City to be dismantled completely and existing loop from City to KR Puram to continue.
- The Final Feasibility Report was submitted in April'2020 duly recommending Proposal-4.
- The Revised Final Feasibility Report duly incorporating the comments/observations of BMRCL was submitted in Jan'2021.

PROPOSAL-4

- Existing flyover loops of City to Tumkur, Tumkur to City and KR Puram to City proposed to be dismantled and existing loop from City to KR Puram to continue.
- KRDCL flyover to continue upto the ramp up location, in the south of Hebbal junction and merge 4 lanes (2+2 lanes) of this flyover into the existing bidirectional flyover with access control movement using fencing/barricading for through traffic.

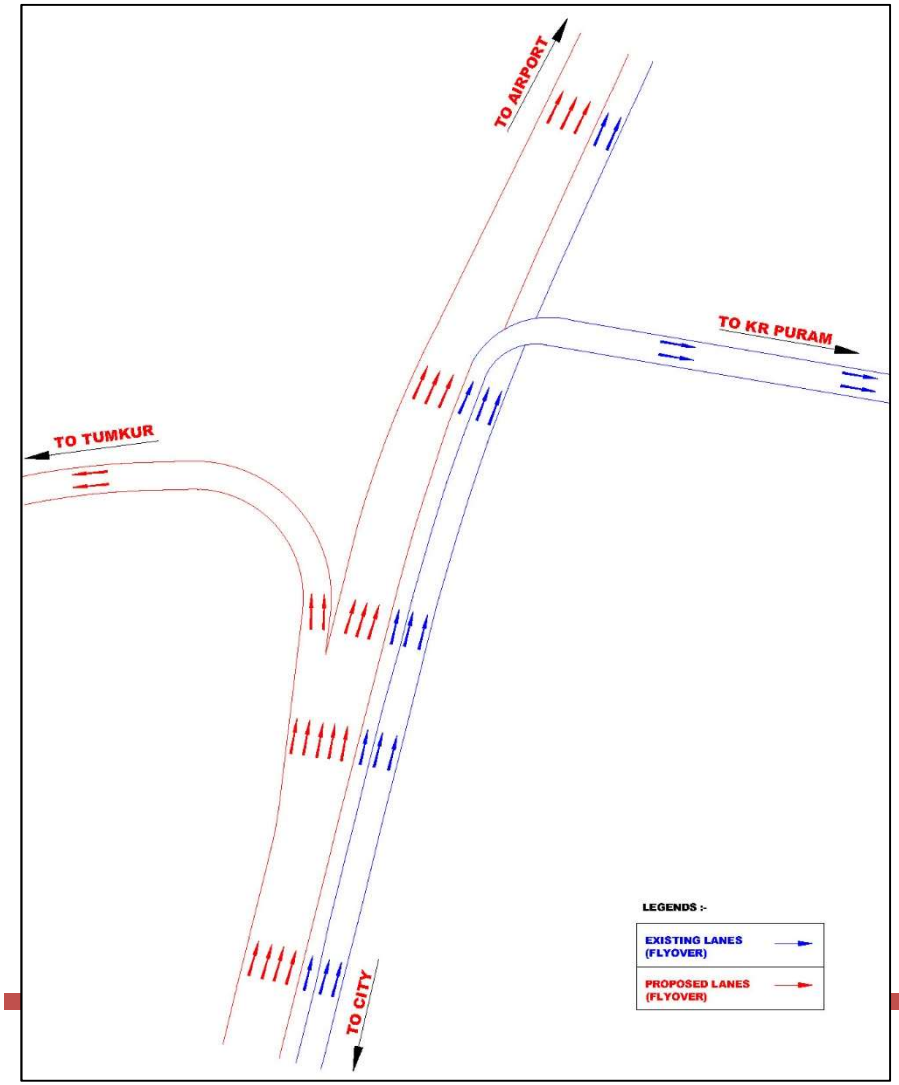
PROPOSAL-4



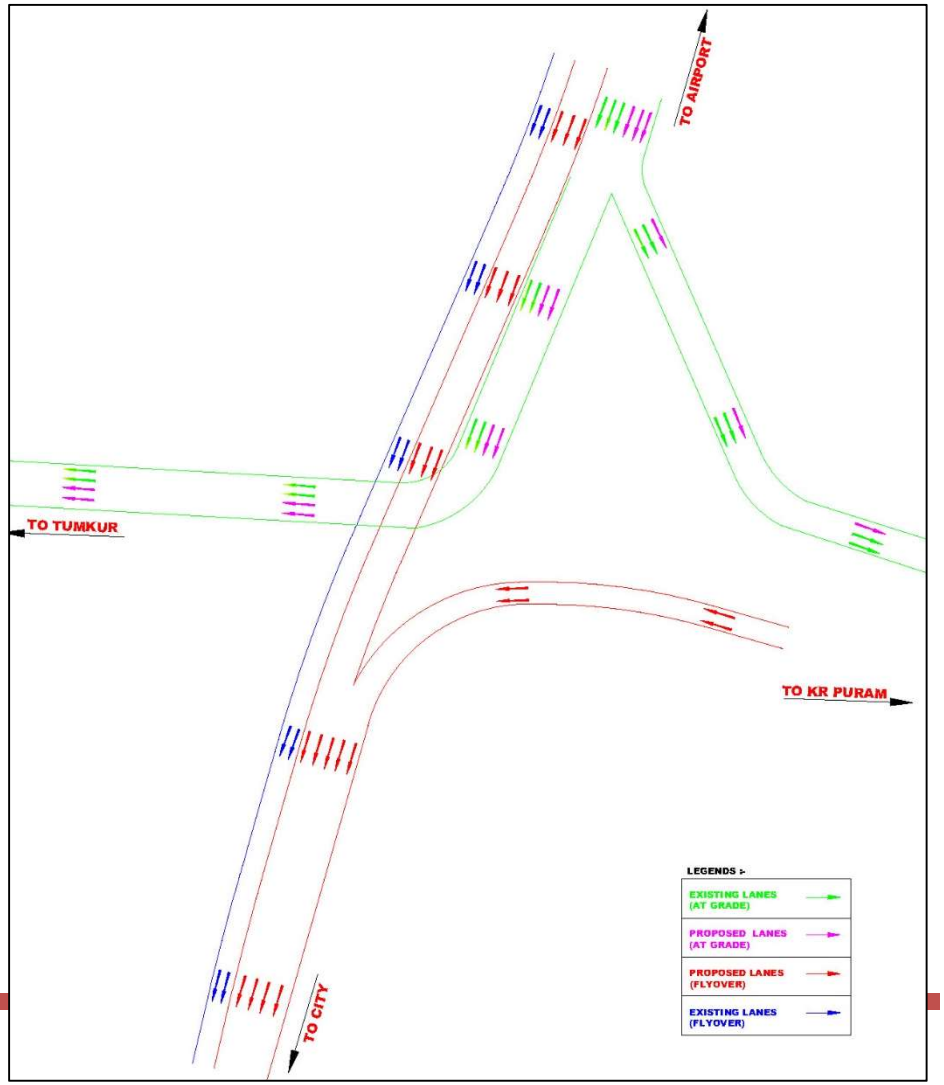
- A new 4-lane flyover to the west of existing flyover for City to Airport. 3 lanes of this flyover will continue towards Airport and 2 lanes will ramp down towards Tumkur
- A new 3-lane underpass from Tumkur to K.R. Puram.
- A new 2-lane flyover for K.R. Puram to City.
- A new 2-lane flyover for K.R. Puram to Airport
- A new 3 lane flyover to the east of existing Hebbal flyover is proposed for Airport to City. 2-lane flyover for KR Puram to City will merge into the new flyover and will ramp down as 4-lane.
- Airport to KR Puram: Existing service road to be widened to 3-lane from 2-lane.
- Airport to Tumkur: New 4-lane at-grade road parallel to existing 2-lane road.
- K.R. Puram to Tumkur: Existing straight road is widened to 4-lane road.
- Tumkur to City: A new 2-lane U-turn underpass towards KR Puram.

PICTORIAL TRAFFIC DIAGRAM

CITY TO ALL DIRECTIONS

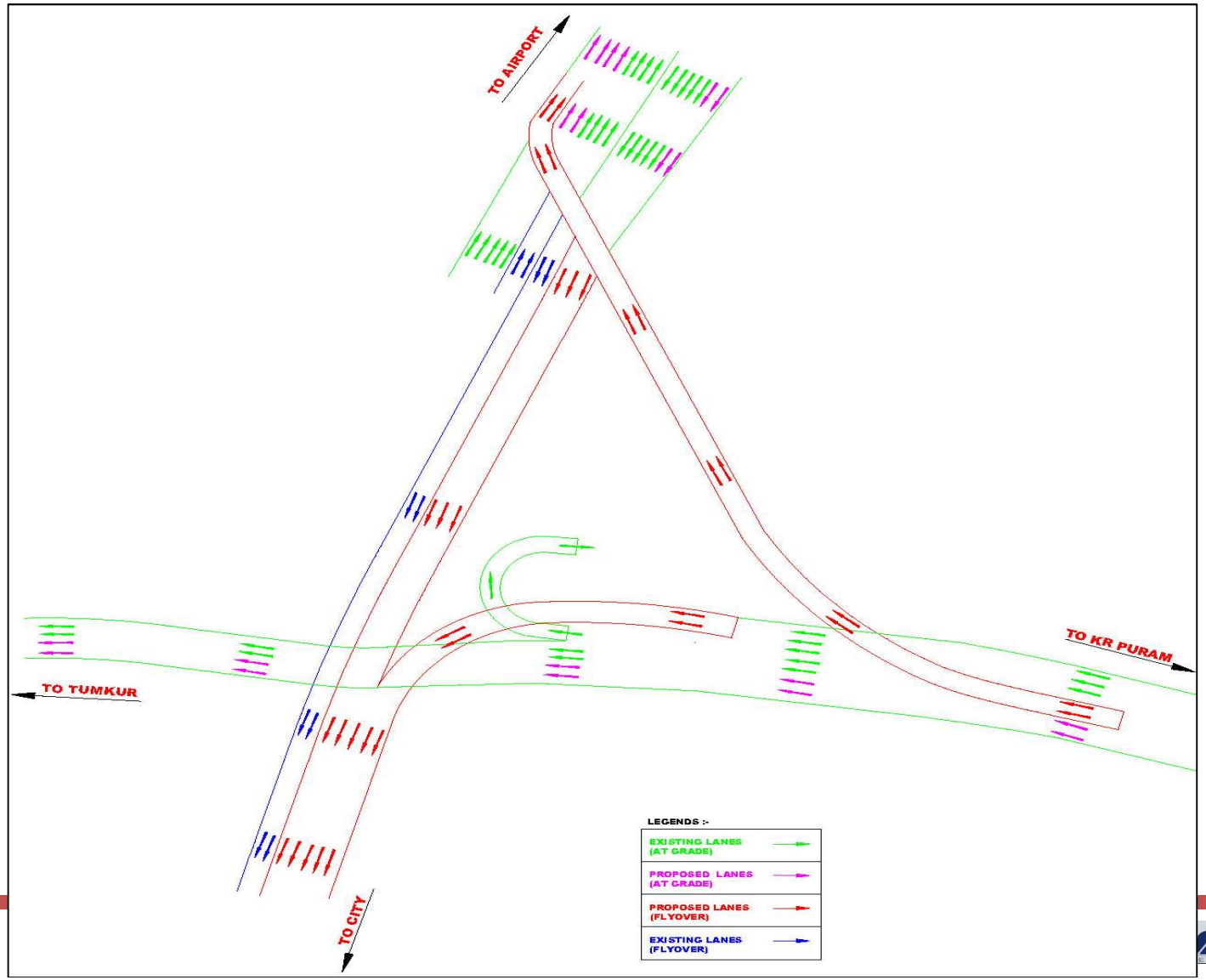


AIRPORT TO ALL DIRECTIONS



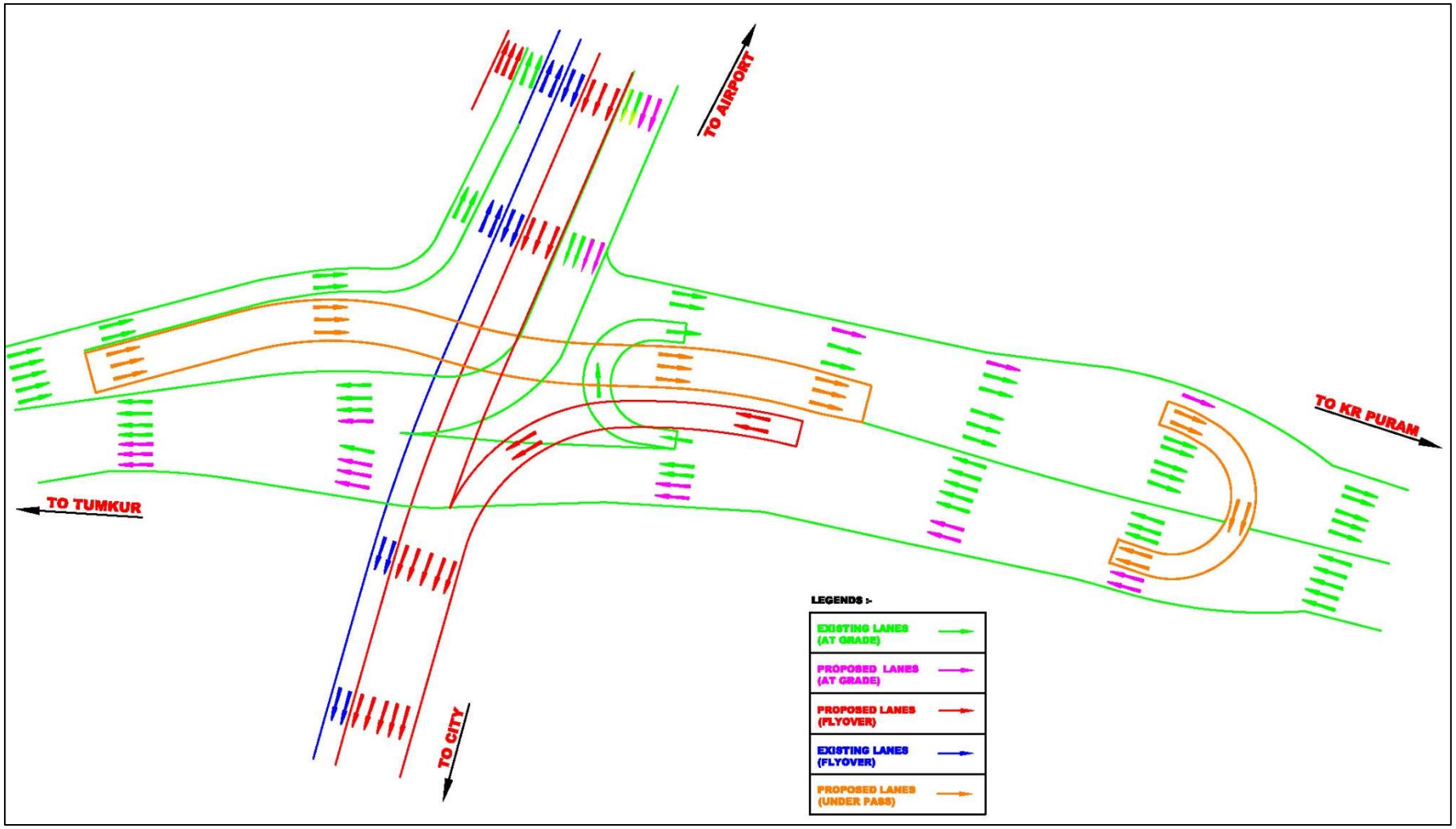
PICTORIAL TRAFFIC DIAGRAM

KR PURAM TO ALL DIRECTIONS



PICTORIAL TRAFFIC DIAGRAM

TUMKUR TO ALL DIRECTIONS

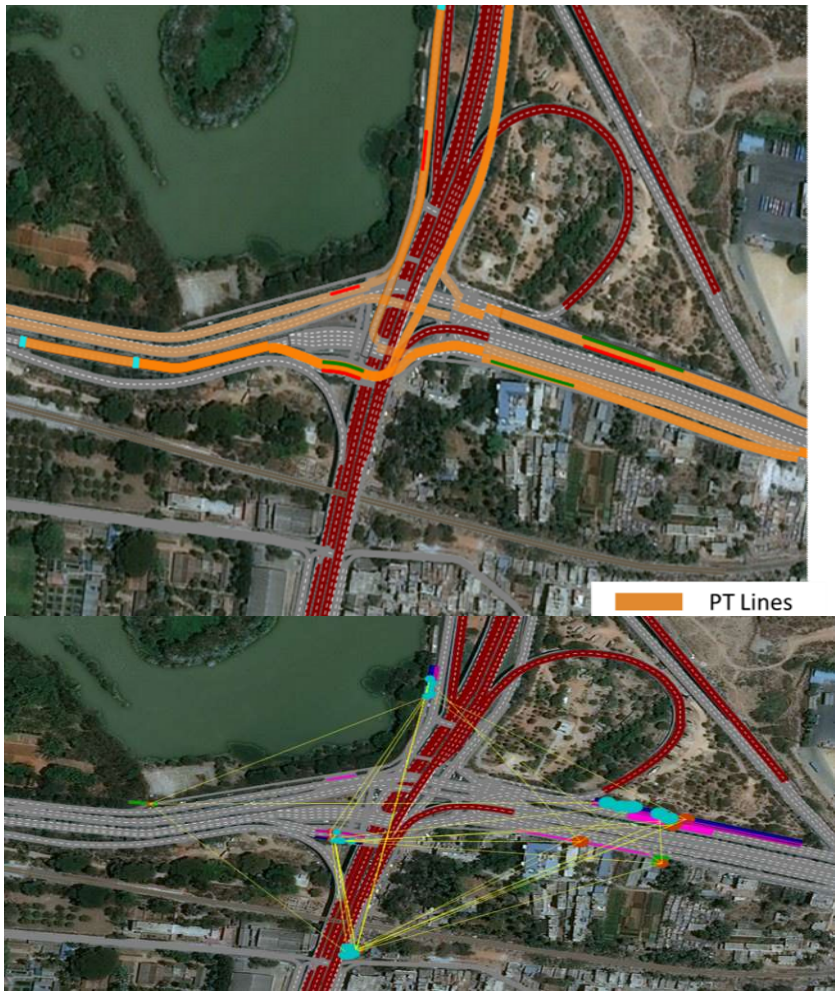


COST - PROPOSAL-4

Details		Proposal 4
Pros & Cons		• Construction can go independent of KRDCL flyover. • Existing NH-flyover towards Airport will remain functional. • Less costly than proposal 5. • All flyovers are planned at 1st level i.e. same as that of the existing flyover. • No hindrance to height of proposed Bangalore Metro Phase – 3 corridor. • Most of the structures proposed are elevated, so permanent acquisition would be done at all ramp-up, ramp-down & pier locations.
Affected Structures (No.)	Govt.	28
	Religious	3
	Pvt.	104
Affected Area (sqm)	Govt.	28277
	Religious	978
	Pvt.	24375
Preliminary Infra. Cost (w/o land & structure)		**Rs. 244 Crore**

TRAFFIC SIMULATION (VISSIM)

- To evaluate the efficiency and effectiveness of proposals.
- Simulation is a driver behavior and perception based model.
- Traffic simulation has been carried out for the following :
  - ✓ Development, Calibration & Validation of Base Year Model - 2019
  - ✓ Traffic Simulation of Capacity Augmentation Proposals - 2051



Base Year Model Validation -Traffic Flow - 2019

$$GEH = \sqrt{\frac{(O-E)^2}{0.5(O+E)}}$$

Where O = Observed Flow
E = Estimated Flow

Observed GEH value is less than 10 for 85% of the values which indicates **good relationship**.

S. No	Direction	Simulated Volumes	Observed Volumes	GEH	Error (%)
1	Hebbal Jn To Yashwantpur/Tumakuru	4189	4303	1.76	2.66%
2	Yashwantpur /Tumakuru to Hebbal Jn	5708	5690	0.24	-0.31%
3	Hebbal Jn To R. K. Puram/Kalyan Nagar	7832	8667	9.19	9.63%
4	R. K. Puram/Kalyan Nagar to Hebbal Jn	6098	6667	7.12	8.53%
5	From Bangalore City to Hebbal Jn	7796	7946	1.69	1.88%
6	Hebbal Jn to Bangalore City	8282	8340	0.64	0.70%
7	Hebbal Jn to Airport	6125	6969	9.43	12.11%
8	Airport to Hebbal Jn	8689	8002	7.52	-8.58%
9	Nagavara Flyover Westbound Bound	5619	5572	0.62	-0.83%
10	Nagavara Flyover Eastbound Bound	6265	7396	13.68	15.29%
11	Bhadrappa Flyover Westbound	4265	4684	6.26	8.95%
12	Bhadrappa Flyover Eastbound	5259	4985	3.82	-5.49%
13	Mehkri Circle Flyover Northbound	6071	5879	2.48	-3.26%
14	Mehkri Circle Flyover Southbound	3910	4693	11.94	16.68%

Base Year Model Validation -Average Speed- 2019

Node	Sections Length in Simulation Model (m)	Observed Speed (KMPH)	Simulated Speed (KMPH)
2 to 1	1568	18	18
4 to 3	2063	18	22
3 to 4	2062	20	24
6 to 5	1795	26	24
5 to 6	1798	29	25
7 to 1	1577	16	18

Simulated Video Base Year (2019)

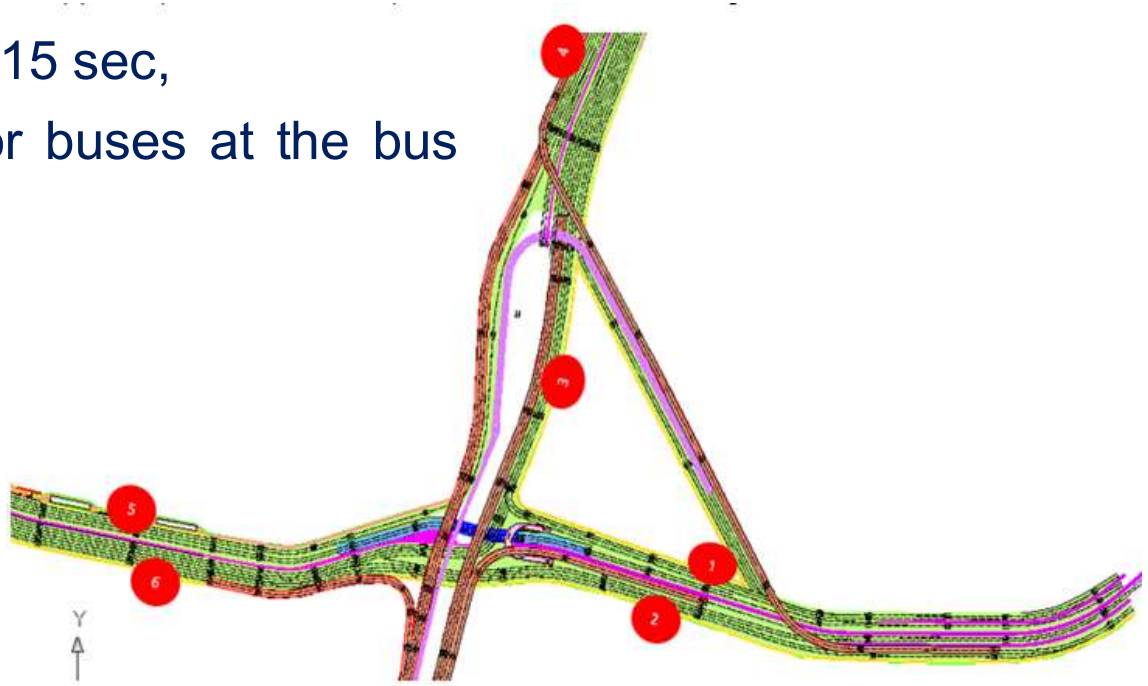
SIMULATED SCENARIOS

- Scenario 1- Estimated Horizon Year (2051) Traffic with field Observed BMTC Buses (2019)

- Scenario 2- Estimated Horizon Year (2051) Traffic with Scheduled BMTC Buses (2019)

ASSUMPTIONS

- Pedestrian Signal phase of 15 sec,
- 45 seconds waiting time for buses at the bus stop.



Proposed Bus Stop Locations

Traffic Input for Horizon Year – Scenario 1

Estimated Traffic for 2051

Mode	Volume (2051)	PCU (2051)
Car	8354	8354
Taxi	6266	6266
TW	11835	8876
Auto	2437	2437
Bus (Pvt., KSRTC etc.)	1044	3132
LCV	1392	2784
Truck	1741	6963
MAV	696	2784
Total	**33765**	**41596**

BMTC Buses Considered in Scenario 1 (As per field observed -2019)

Direction/Bus Stop	Number of Buses
Towards K R Puram	395
From K R Puram to Airport and Tumkur	24
Towards Tumkur	171
Towards Airport	13
Towards City	125
Total	**728**

Simulated Video Scenario 1

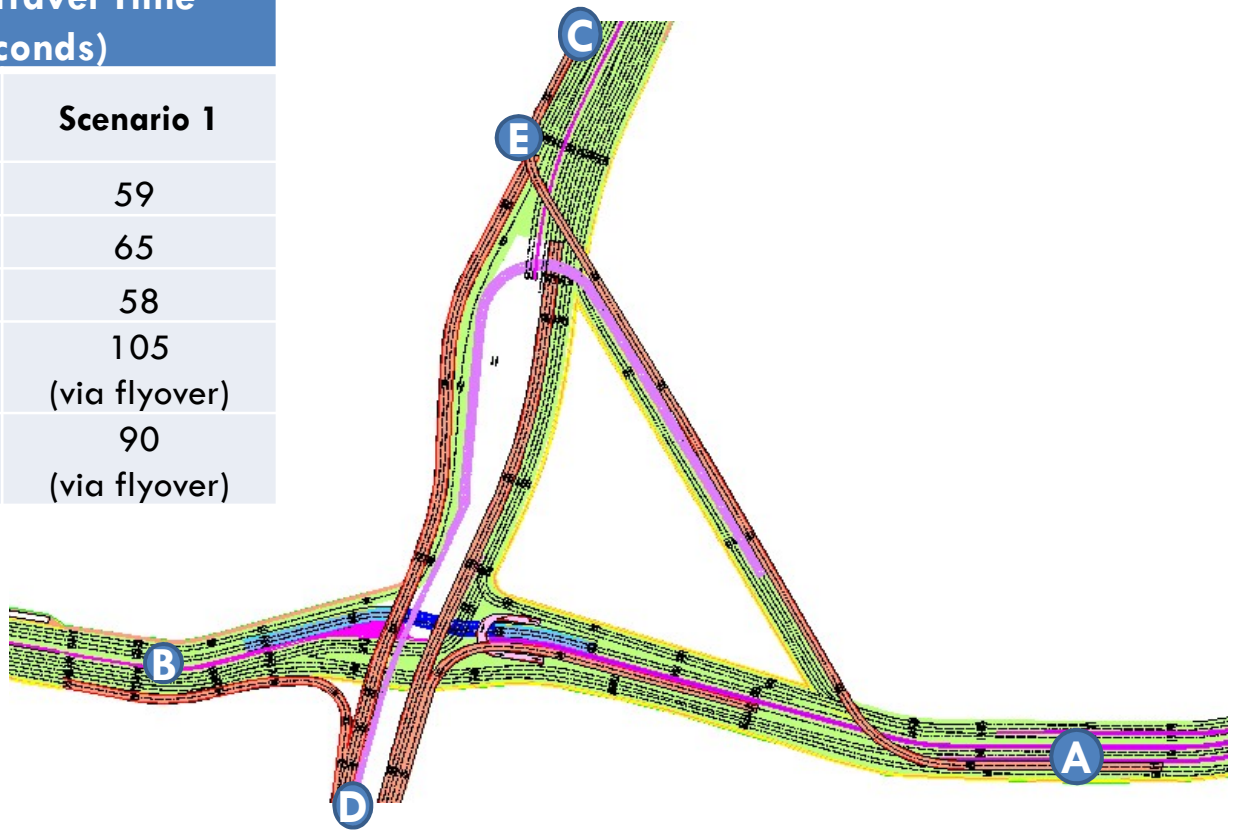
Scenario 1: Simulated Speed

Observed speed of the network in the range of 30-50 kmph.

Node	Observed Speed -2019 (KMPH)	Simulated Speed -2051 (KMPH)
2 to 1	18	43
4 to 3	18	41
3 to 4	20	40
6 to 5	26	38
5 to 6	29	38
7 to 1	16	44

Scenario 1 – Simulated Travel Time

Direction	Sections Length (m)	Vehicle Travel Time (Seconds)	
		Base Year 2019	Scenario 1
A-B	750	152	59
B-C	610	132	65
B-A	780	220	58
A-C	1050	165	105 (via flyover)
D-E	880	145 (via flyover)	90 (via flyover)



Traffic Input for Horizon Year – Scenario 2

Traffic input same as Scenario 1 except BMTC

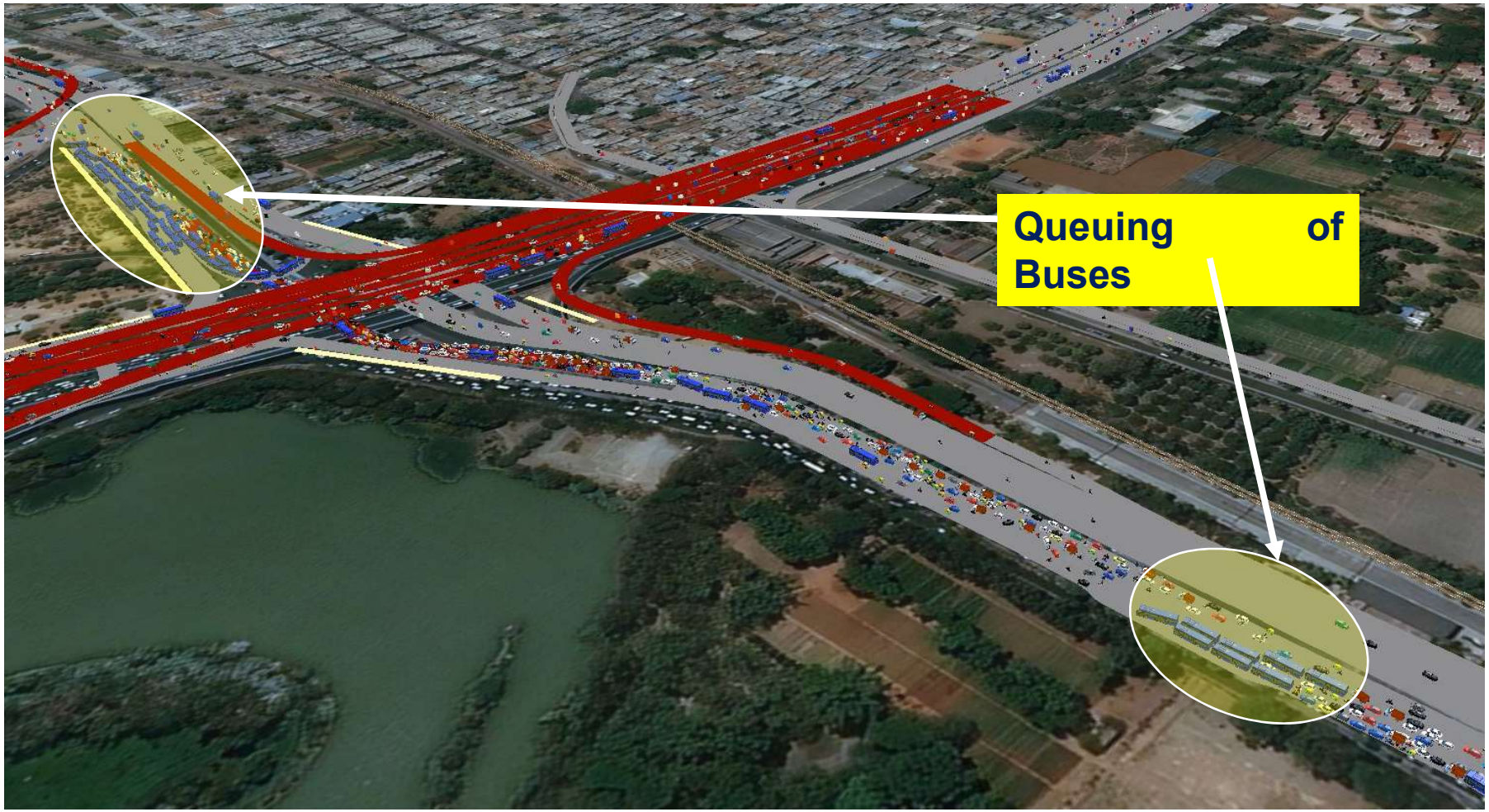
Mode	Volume (2051)	PCU (2051)
Car	8354	8354
Taxi	6266	6266
TW	11835	8876
Auto	2437	2437
Bus Bus (Pvt., KSRTC etc.)	1044	3132
LCV	1392	2784
Truck	1741	6963
MAV	696	2784
Total	**33765**	**41596**

BMTC Buses Considered in Scenario 2 (As per Current Bus Schedule)

	Hebbal	Tumkur	City	Airport	K. R. Puram	Total
Hebbal	0	77	6	0	152	**235**
Tumkur	77	0	2	6	96	**182**
City	6	15	0	237	3	**261**
Airport	0	6	224	0	25	**255**
K. R. Puram	152	91	1	21	0	**264**
Total Bus Trips	**235**	**189**	**233**	**264**	**276**	**1197**

Simulated Video Scenario 2

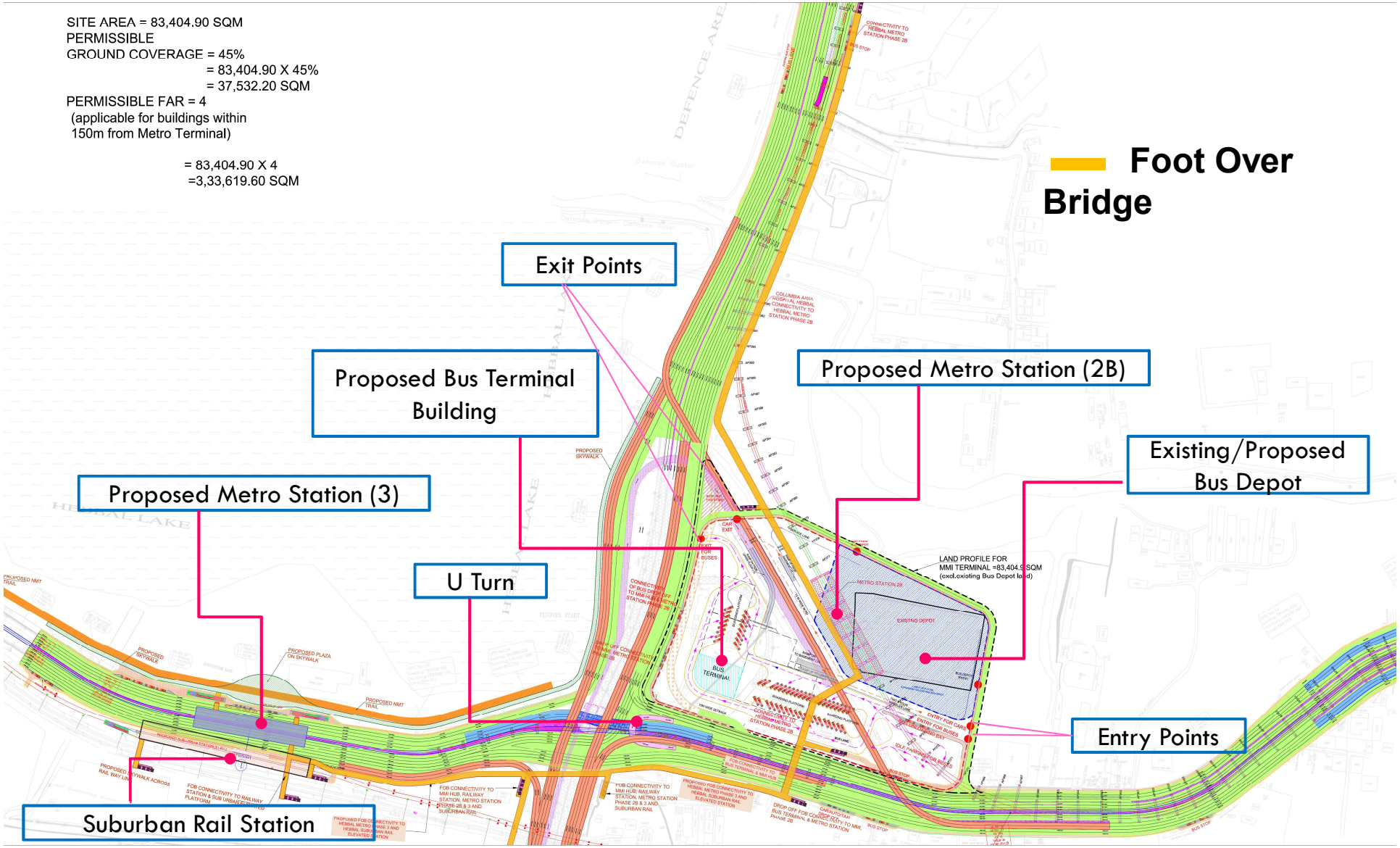
Major Observations – Scenario 2



MMI PROPOSAL

SITE AREA = 83,404.90 SQM
PERMISSIBLE
GROUND COVERAGE = 45%
= 83,404.90 X 45%
= 37,532.20 SQM
PERMISSIBLE FAR = 4
(applicable for buildings within
150m from Metro Terminal)

= 83,404.90 X 4
=3,33,619.60 SQM



Kindly send your opinion to
hebbalskyover@bmrc.co.in