Date:05th May 2025
Bengaluru

To
The Additional Chief Secretary
Urban Development Department
Government of Karnataka
Vikasa Soudha, Bengaluru - 560001

Dear Sir,

Sub: Review of DPR for Construction of Underground Vehicular Tunnel from Hebbal Esteem Mall junction to Silk Board KSRP junction - **Report of Expert Committee -Reg**

Ref: G.O No: UDD -34/MNY2024 (E) dated 07th April 2025

Vide above G.O, the expert committee was constituted to review the DPR for Construction of Underground Vehicular Tunnel from Hebbal Esteem Mall junction to Silk Board KSRP junction and submit the report. Accordingly, committee has carried out the detailed review of DPR documents duly taking into account the terms of reference laid down in G.O.

The expert committee report signed by all four members is hereby submitted for your consideration.

Thanking you,

Yours faithfully

Siddanagouda Hegaraddi
Chairman of the Committee

Encl: Expert Committee report (86 pages)

Expert Committee Report

on

DPR for Construction of Underground Vehicular Tunnel from Hebbal Esteem Mall junction to Silk Board KSRP junction.

05th May 2025

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1. INTRODUCTION

Bengaluru is known as “Silicon Valley of India” (IT capital of India) because of its role as the nation’s leading information technology (IT) exporter. Indian technologicall organisations like ISRO, Infosys, Wipro etc. are headquartered in the city. Bengaluru is a demographically diverse city; Bengaluru is the second fastest growing major metropolis in India. It is home to many educational and research institutions in India, such as Indian Institute of Science (IISc), Indian Institute of Management (IIMB), Indian Institute of Information Technology (IIITB), National Institute of Fashion Technology, National Institute of Design, (NID R&D Campus), National Law School of India University (NLSIU) and National Institute of Mental Health and Neurosciences (NIMHANS). Numerous state-owned aerospace and defense organizations, such as Bharat Electronics Limited (BEL), Hindustan Aeronautics Limited (HAL) and National Aerospace Laboratories (NAL), DRDO, etc. are located within the city.

Bengaluru has experienced significant and exponential growth of population and traffic since 2000, driven by urbanization and economic opportunities, particularly in the IT / BT sector and service sector. The population has also increased dramatically, with a surge in migrants seeking employment and a flourishing IT sector. This growth has led to a high population density and challenges related to infrastructure and resources. Widening of existing roads haven’t been taken up by concerned authorities considering the difficulty in Land acquisition. Acquiring land will have large social impact due to large-scale demolition of major buildings & commercial establishments all along the roads.

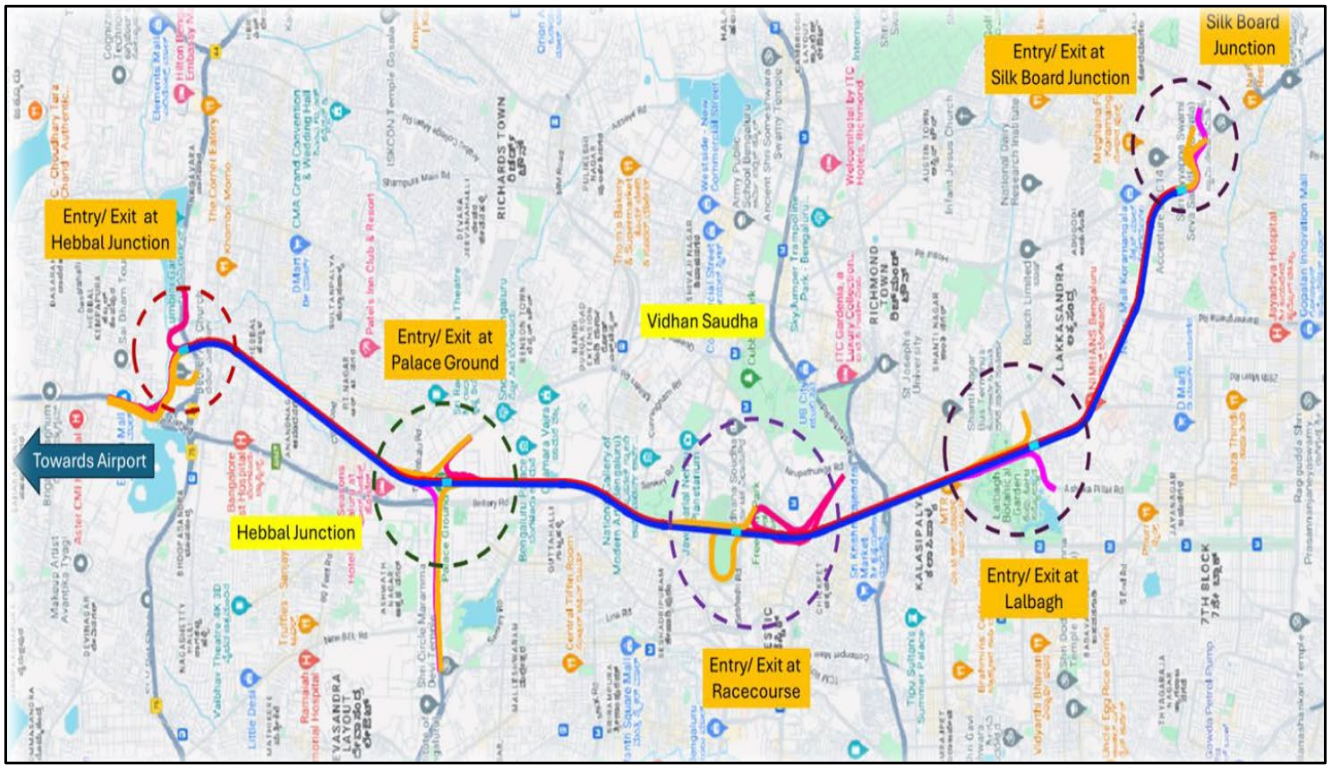
2. PROJECT BACKGROUND

In order to address the persistent challenge of continuous increase in vehicular congestion due to rapid urbanization and population growth of Bengaluru, BBMP had earlier assigned the work of “Consultancy services for preparation of Comprehensive Bengaluru city road infrastructure plan to decongest traffic and to prepare comprehensive traffic management plan for proposal of Vehicular tunnel /Grade separator / Road widening in selected corridors” to ***M/S Altinok Consulting Engineering Inc. In Jv with M/S Lion Engineering Consultants Pvt. Limited***. The feasibility study has identified and recommended development of Tunnel Roads along **North - South corridor** of length 18.5 km from Hebbal

to Silk Board Junction and **East-West corridor** of length 28 km from K.R. Puram to Nayandahalli.

The Government of Karnataka (GoK) announced in the budget of 2025-26 to take up North – South and East -West Corridors tunnel projects. Subsequently, BBMP decided to take up North – South corridor on priority and entrusted the work of preparation of Detailed Project Report (DPR) to **M/S. RODIC Consultants Pvt Ltd**. Accordingly, the DPR has been prepared and submitted to BBMP. BBMP has further submitted to GoK for approval.

The key map indicating the proposed North- South corridor alignment (Tunnel) including the location of entry/ exit ramps at Hebbal, Mekhri Circle, Race Course, Lal Bagh and Silk Board Junction is furnished below.



GoK has constituted an Expert Committee for **"Review of DPR for Construction of Underground Vehicular Tunnel from Hebbal Esteem Mall junction to Silk Board KSRP junction"** vide Govt. order No:UDD -34/MNY2024 (E) dated 07th April 2025 (Copy enclosed as **Annexure 1**) with following members: -

(i)	**Sri. Siddanagouda Hegaraddi;** **Executive Director (Civil),** **Bangalore Metro Rail Corporation Limited.** **Bengaluru.**	**- Chairman**
(ii)	**Sri. Madhava;** **Chief Engineer (Retd),** **Public Works Department,** **Govt of Karnataka.** **Bengaluru.**	**- Member**
(iii)	**Col. Vinod Shukla;** **Tunnel Expert,** **Managing Director** **Frontier Geoservices Pvt. Ltd.** **New Delhi**	**- Member**
(iv)	**Major. Ashwath Kumar .B;** **Highway & Road Safety Expert,** **Managing Director,** **LARATECH Engineering Services Pvt. Ltd.** **Bengaluru**	**- Member**
(v)	**Sri. Dhananjaya;** **Executive Engineer,** **Bruhat Bengaluru Mahanagara Palike,** **Bengaluru.**	**- Co-ordinator**

3. TERMS OF REFERENCE.

As per Govt Order No: UDD - 34/MNY2024 (E) dated 07th April 2025, the terms of reference are as follows:-

i. To examine whether all essential components and elements are comprehensively covered in DPR.
ii. To examine whether any unnecessary / unrealistic elements are included in the DPR.
iii. To check whether any of the most required elements are left out in the DPR.

iv. To examine whether DPR includes all required maps, Design & Drawings and fundamental elements and also check whether estimate is proper.

v. To provide any other advisory recommendations

4. APPROACH METHODOLOGY

The Approach methodology was worked out considering the Terms of reference. DPR documents received from UDD / BBMP were reviewed as per detail scope of work of DPR consultant for compliance with various aspects corresponding to relevant Codes, Standards and guidelines.

4.1 Start off meeting and Presentation on DPR by Consultant.

Start off meeting was held on 10th April 2025 involving all committee members, BBMP Officials and Presentation on DPR by Consultant to broadly understand the project.

4.2 Site visit

Site visit was carried out on 19th April 2025 by committee members along with BBMP officials & DPR consultants for making assessment of alignment, availability of land, site constraints, traffic issues at entry exit ramps, shaft locations and various other aspects such as storm water drainage, structures, trees and utilities likely to be affected, etc.

4.3 Clarifications sought from DPR Consultant

Based on the presentation and preliminary review of documents, the clarifications were sought from the DPR consultant. The queries/ clarifications sought, clarifications provided by DPR consultant, further remarks by the Committee are tabulated and enclosed as **Annexure 2**.

4.4 Detailed Review and Report

Meetings were held on various dates for detailed review of the documents. The details of site visits and meetings are placed at **Annexure 3**. The following DPR documents have been reviewed by the committee.

(i) Volume - I - Main Report

(ii) Volume - II A - Geotech Design Report

(iii) Volume - II B - Structural Design Report
(iv) Volume - II C - Electrical Design Report
(v) Volume - II D - Ventilation Design Report
(vi) Volume - III - GIR Report
(vii) Cost Estimate – (Package 1 & 2)
(viii) Drawings – (Package 1 & 2)

Based on the detailed review of documents and site visits, the chapter wise observations by the committee have been prepared and attached as **Annexure 4**.

5. SUMMARISATION AS PER TERMS OF REFERENCE

5.1 Terms of Reference –(i):

To examine whether all essential components and elements are comprehensively covered in DPR.

Based on the detailed chapter wise report prepared by the committee, the important observations and recommendations are tabulated below.

Sl	Observations	Recommendations
	VOLUME – I : MAIN REPORT	
	Alignment Study	
1	It is noted that the alignment is running almost parallel to the proposed metro line. It is also noticed that one of the shafts is proposed to be located within Lal Bagh Botanical Garden which is an environmentally sensitive area.	Positioning one of the shafts within Lal Bagh Botanical Garden area needs reexamination in view of environmental sensitivity.
2	The entry/ exit ramps are provided at appropriate locations, considering the constraints of availability of land. It is noted that efforts have been made to locate the entry/ exit ramps in the vicinity of existing	Necessary provision for improvement of road, if required by widening, to avoid traffic congestion due to merging traffic emerging from tunnels with the surface traffic as existing

Sl	Observations	Recommendations
	signal-controlled junctions to avoid traffic conflicts to the extent possible However, the introduction of entry/ exit ramps may cause traffic congestion due to the merging of traffic emerging from tunnel with surface traffic.	road widths get reduced due to introduction of Entry/ Exit Ramps. The existing signal-controlled junctions may require an improvement due to increased traffic from tunnel entry/exits which may be addressed suitably and detailed traffic management plan may be included in the DPR.
3	Intermediate lane configuration is proposed for entry & exit ramps at Palace Ground/Mekri Circle. Provision of intermediate lanes in ramps would hinder smooth movement of traffic causing delays and risks to the tunnel users.	Intermediate lane configuration is proposed for entry & exit ramps at Palace Ground/Mekhri Circle. whereas, as per IRC SP 87-2019, a minimum of two-lane configurations should be provided for entry and exit ramps.
4	The drainage arrangement proposed is without any design calculations and proper scheme. There are crests and sags in the vertical alignment which affects the drainage flow. A detailed calculation is required to understand the adequacy of the proposed drainage scheme. Hence, the drainage scheme couldn't be reviewed.	Detailed calculation to understand the adequacy of the proposed drainage arrangements is required.
5	It is noted in the drawing that the existing nallah at the downstream of Hebbal Tank waste weir (Ch: 450) is proposed to be diverted through U-turn with long detour towards Airport which is unrealistic. Detailed hydraulic calculations and designs for the proposed diversion of nallah are not available.	The proposed diversion of nallah at the downstream of Hebbal Tank waste weir (Ch: 450) is to be dealt with utmost care and avoid such long detour. It is suggested to carry out the detailed hydraulic calculations considering 100 years return flood period / SPF.
	Engineering Surveys and Investigation	
	Geotechnical & Geophysical Investigation	
6	The submitted GIR is mainly based on geophysical studies and geotechnical	The GIR needs to be updated after completing all ongoing geotechnical

Sl	Observations	Recommendations
	investigation of only 4 boreholes. The remaining investigations are in progress as indicated in the report. However, ERT is not conducted to study the ground water presence/ aquifers.	investigations including updating the Geological L-Section. It is strongly recommended to conduct the ERT test to study the presence of ground water and aquifers.
	Traffic Surveys Analysis	
7	Even though the traffic volume survey is conducted at 9 cordon points and worked out the total daily PCUs at each of the locations as furnished in Table 54, the modal share details are not available in the report. It is noted that the traffic analysis has been carried out based on LoS to arrive at the lane requirement for the project. In the absence of present and projected mode wise breakup of daily PCUs, peak hour PCUs duly taking into account the modal share and estimated modal shift due to other competing modes of transport such as BMTC, Metro lines, Suburban rail etc. the analysis based on LoS to arrive at lane configuration requirement could not be verified.	The traffic projections to arrive at the lane requirements should be based on the details in terms of PCUs duly taking into account the modal share and estimated modal shift due to other competing modes of transport such as BMTC, Metro lines, Suburban rail etc. instead of LoS basis.
8	In DPR, the horizon year considered is 2041 which is only 10 years (from the date of completion) instead of 25 years as per standard guidelines.	As per IRC SP 87: 2019, the number of lanes in a traffic tunnel shall be based on the traffic projections for 25 years. As per traffic data, 2041 demands only 2+2 lanes with paved shoulders, however the proposed 3+3 lane configuration is satisfying the projected traffic requirement for 25 years of horizon period. In view of this, either horizon year needs correction or lane configuration needs modification.

Sl	Observations	Recommendations
9	The general apprehension of stakeholders is that the road tunnel project on proposed alignment will become redundant as it is running almost parallel with the proposed metro line. This apprehension could not be addressed in the absence of breakup of peak hour traffic data with modal share and projected peak hour traffic data,	The DPR documents should clearly illustrate the justification to overcome such apprehensions of the stakeholders with adequate data and analysis.
	Project Implementation and Scheduling	
10	The timelines given in the schedule are very tight considering the complications in land acquisition, utility shifting, tree cutting, traffic diversion/ movement restrictions, restricted working hours in the city, the complexity of geology witnessed during the metro tunneling.	Detailed Work Breakdown Schedule with major activities to be included in the DPR.
11	Detailed method statements for critical activities like shaft excavation, breaking and widening for additional lanes at entry/exit areas, underground tunnel excavations, breaking for construction of cross passages etc. are not available.	The Detailed method statement for critical activities like shaft excavation, breaking and widening for additional lanes at entry/exit areas, underground tunnel excavations, breaking for construction of cross passages should be prepared and included in the DPR.
	Preliminary Cost Estimation	
12	The cost of TBM considered is based on an enquiry from only one vendor i.e., M/s. Herrenknecht AG which is not as per the laid down norms in KPWD.	Wherever Non SoR/ market rates are considered for estimate, normally in KPWD, three quotations from the different firms are collected and the least rate amongst the three, after obtaining approval of competent authority, is to be followed.
13	The Lumpsum provision is made in the cost estimate for Land Acquisition, utility shifting, instrumentation, BCS, Electric buses, toll collection system etc.	The detailed cost estimation is required for Land Acquisition, utility shifting, instrumentation, Building Condition Survey, Electric buses, toll collection system etc. as these

Sl	Observations	Recommendations
		components involve major cost implications.
14	Cost towards transportation and dumping of TBM muck (25,78,932 cum), secondary grouting, establishment of the casting yard, cutter head intervention, cutter discs consumptions, closing of open well/ Borewell are not considered in cost estimate.	Cost towards transportation and dumping of TBM muck (25,78,932 cum), secondary grouting, establishment of the casting yard, cutter head intervention, cutter discs consumptions, closing of open well/ Borewell are to be considered in the cost estimate.
15	The cost towards “Cost of extra TBM taken by TBM” (Item No. O of Rate Analysis for tunnel boring (Page 142) for Rs. 306.00 Crore is not clear.	The cost towards “Cost of extra TBM taken by TBM” (Item No. O of Rate Analysis for tunnel boring (Page 142) for Rs. 306.00 Crore is not clear. This line item in estimate is to be reexamined and estimate corrected accordingly.
16	Cost towards Operation & Maintenance for 25 years is not included.	The cost towards Operation & Maintenance for 25 years is to be included.
	VOLUME - II B : STRUCTURAL DESIGN REPORT	
17	Creep and temperature load are not considered in design.	Creep and temperature load need to be considered in design.
18	Floatation check for underground structures could not be found in the design reports.	Floatation check for underground structures is necessary.
	VOLUME - II C : ELECTRICAL DESIGN REPORT	
19	9 Electrical substations have been proposed in TBM tunnel portion. It is noted that one substation requires 2 cross passages at a distance of 11.785 m (c/c) construction of cross passages at such close proximity is practically not feasible.	It is recommended to avoid locating Electrical substations within the TBM tunnel portion as provision of such large space required for the substation by dismantling the tunnel rings is extremely risky and costly. Hence the possibility of locating the

Sl	Observations	Recommendations
		electrical substations outside the TBM tunnels may be explored.
20	The parameters considered in the lighting report do not match the design reports. For eg., the design speed in lighting simulations is shown as 100 kmph whereas the design speed as per reply by consultant is 80 kmph. The calculation for intensity of sunlight at portal is not provided in the report. The higher value will lead to a larger number of lights. More lights mean more power requirement	The design speed considered in lighting simulation is not in line with the design speed of the project. Hence need correction.
	VOLUME - II D : VENTILATION DESIGN REPORT	
21	The transverse ventilation scheme proposed is without the cost comparison studies with alternate systems. The ventilation systems will have major impact on the project cost due to power consumption and maintenance requirements.	As per IRC SP 91:2019, longitudinal ventilation system is economical for tunnel length up to 4km and the proposed tunnel is having openings at less than 4 km interval. The possibility of adopting longitudinal ventilation system may be explored.
22	On studying various cross sections like TBM tunnel, cross passages, ramps, shafts, buildings, it is noted that the fire main and hydrants are shown on RHS in TBM tunnel and on LHS in ramps. It is not clear how continuity is ensured. The design calculations for pumps capacities, sprinkler system, mist system etc are not provided.	The mismatch in the fire main and hydrant location shown in various cross sections needs to be corrected. The design calculations for pumps capacities, sprinkler system, mist system etc are to be included in the design report.

5.2 Terms of Reference –(ii)

To examine whether any unnecessary / unrealistic elements are included in the DPR

It is noted in the drawing that the existing nallah at the downstream of Hebbal Tank Weir (Ch: 450) is proposed to be diverted through U-turn with long detour towards Airport which is unrealistic.

5.3 Terms of Reference – (iii)

To check whether any of the most required elements are left out in the DPR

On reviewing the DPR documents it is found that the following important elements are left out.

(i) Land Acquisition Plan & Schedules.
(ii) Utility mapping and relocation plan.
(iii) Tree enumeration and relocation plan.
(iv) Environmental Impact Assessment and Environmental Mitigation Plan.
(v) Social Impact Assessment report and R&R.
(vi) Technical Specifications for all items of work.
(vii) Comprehensive Disaster Management and Security Plan.
(viii) Pavement design for all sections other than NATM tunnels.
(ix) Hydraulic design calculations for nallah diversion and storm water drainage.

5.4 Terms of Reference – (iv)

To examine whether DPR includes all required maps, design & drawings and fundamental elements and also check whether estimate is proper.

Generally, all the required maps, design and drawings are available except the following items.

- The design and drawing of Nallah cross drainage structure at the downstream of waste weir of Hebbal Tank is not available.
- The deficiencies noticed in the design and drawings are brought out under the respective chapters.
- The fundamental/ essential elements left out have been listed under ToR – 3.
- Generally, estimate is properly prepared however, few deficiencies noticed are brought out under respective volume/ chapters.

5.5 Terms of Reference – (v)

To provide any other advisory recommendations

The committee based on the experience/ expertise of its members desires to advise the following.

i. The metro tunnels in the Bengaluru area have encountered various types of rock formations. Test reports from boreholes and face mapping during tunneling indicate that rocks have an Unconfined Compressive Strength (UCS) up to 320 N/sqmm (MPa) due to the presence of gabbro. It is advisable to conduct thorough geotechnical investigations to avoid unexpected geological conditions that could affect the project schedule and lead to cost overruns.

ii. The project scheduling is based on a planned average monthly progress of 150 meters. However, the actual monthly average progress achieved in metro tunneling is approximately 100 meters. This discrepancy exists despite the excavation diameter of the metro tunnel (6.65 meters) being significantly smaller than the proposed road tunnel diameter (15.2 meters). The practical experience gained from metro projects should be considered when preparing the detailed scheduling of the proposed project

iii. Given the expected challenges in constructing the large diameter tunnel in Bengaluru's complex geology, it is advisable to explore options for optimizing the tunnel's cross-section. This approach can help decrease the size of the TBM, thereby minimizing execution difficulties and reducing the project's cost and timelines.

iv. In major infrastructure projects, time and cost overruns are primarily due to the unavailability of unobstructed Right of Way (RoW). Therefore, it is recommended that at least 90% of the work site should be free from encumbrance prior to awarding the contract.

v. It is suggested to use abandoned quarries in and around Bengaluru for disposal of muck generated from the project so that unused abandoned quarries could be effectively utilized.

vi. Given the presence of extremely hard and highly abrasive rock formations in Bengaluru, it is imperative to carefully select and design the type of TBM (Tunnel Boring Machine) to prevent significant breakdowns during the tunnel drives, which are projected to span almost 4km. Additionally, this necessitates an analysis on the effects of vibrations generated by tunneling and their impact on structures within the influence zone.

vii. For successful implementation of such infrastructure projects within the city, a single window monitoring committee may be constituted for smooth and timely clearances for various impediments like Land acquisition, utility diversion, traffic management, tree removal, etc.

viii. A relevant technical committee / team may be established to oversee the preparation of the feasibility study and Detailed Project Report (DPR) from the inception stage. This will help prevent delays in the preparation of the DPR, subsequent approvals and cost/time overruns.

The detailed report after reviewing the DPR documents is hereby submitted as desired for further consideration by the Government.

Siddanagouda Hegaraddi	**Madhava**	**Vinod Shukla**	**Maj.Ashwath Kumar. B**
Chairman	Member	Member	Member

6. ANNEXURES

6.1 ANNEXURE 1- G.O No: UDD -34/MNY2024 (E) dated 07th April 2025

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ:- ಬೆಂಗಳೂರು ನಗರದ ರಾಷ್ಟ್ರೀಯ ಹೆದ್ದಾರಿ 7 ರ "ಹೆಬ್ಬಾಳ ಮೇಲ್ಸೇತುವೆ (ಎಸ್ಟೀಮ್ ಮಾಲ್) ಪ್ರದೇಶದಿಂದ ಹೊಸೂರು ರಸ್ತೆಯ ಸಿಲ್ಕ್ ಬೋರ್ಡ್ ಜಂಕ್ಷನ್‌ನ ಮೇಲ್ಸೇತುವೆ ವರೆವಿಗೂ" ವಾಹನ ಸುರಂಗ ಮಾರ್ಗ (Urban Tunnel) ನಿರ್ಮಿಸಲು ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯನ್ನು ಪರಿಶೀಲಿಸಲು ಸಮಿತಿ ರಚನೆ ಕುರಿತು.

ಓದಲಾಗಿದೆ:- 1) ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: ನಅಇ 34 ಎಂಎನ್ ವೈ 2024 (ಇ), ದಿನಾಂಕ: 04-09-2024.
2) ಮುಖ್ಯ ಆಯುಕ್ತರು, ಬಿಬಿಎಂಪಿ ರವರ ಪ್ರಸ್ತಾವನೆ ಸಂಖ್ಯೆ: ಬಿಬಿಎಂಪಿ/ಪ್ರ.ಆ/ಪಿಆರ್/1794/2024-25, ದಿನಾಂಕ: 12-02-2025.

ಪ್ರಸ್ತಾವನೆ:

ಮೇಲೆ ಓದಲಾದ (1) ರ ಆದೇಶದಲ್ಲಿ ಬೆಂಗಳೂರು ನಗರದ "ಹೆಬ್ಬಾಳ ಮೇಲ್ಸೇತುವೆ (ಎಸ್ಟೀಮ್ ಮಾಲ್) ಪ್ರದೇಶದಿಂದ ಹೊಸೂರು ರಸ್ತೆಯ ಸಿಲ್ಕ್ ಬೋರ್ಡ್ ಜಂಕ್ಷನ್‌ನ ಮೇಲ್ಸೇತುವೆ ವರೆವಿಗೂ" ವಾಹನ ಸುರಂಗ ಮಾರ್ಗವನ್ನು ಟ್ವಿನ್ ಟ್ಯೂಬ್ ಮಾದರಿಯಲ್ಲಿ ನಿರ್ಮಿಸಲು ಸರ್ಕಾರದ ತಾತ್ವಿಕ ಅನುಮೋದನೆ ನೀಡಿ ಆದೇಶಿಸಲಾಗಿತ್ತು.

ಮೇಲೆ ಓದಲಾದ (2) ರ ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ ಬೆಂಗಳೂರು ನಗರದ ಪ್ರಸ್ತಾಪಿತ ರಾಷ್ಟ್ರೀಯ ಹೆದ್ದಾರಿ 7 ರ ರಸ್ತೆ ಪಥವನ್ನು "ಹೆಬ್ಬಾಳ ಮೇಲ್ಸೇತುವೆ (ಎಸ್ಟೀಮ್ ಮಾಲ್) ಪ್ರದೇಶದಿಂದ ಹೊಸೂರು ರಸ್ತೆಯ ಸಿಲ್ಕ್ ಬೋರ್ಡ್ ಜಂಕ್ಷನ್‌ನ ಮೇಲ್ಸೇತುವೆ ವರೆವಿಗೂ" ಭೂಗತ ವಾಹನ ಸುರಂಗ ಮಾರ್ಗ (Urban Tunnel) ನಿರ್ಮಿಸಲು ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯು ಸೇರಿದಂತೆ ಕೆಲವು ಅಂಶಗಳಿಗೆ ಅನುಮೋದನೆ ಕೋರಿ ಮುಖ್ಯ ಆಯುಕ್ತರು, ಬಿಬಿಎಂಪಿ ರವರು Detailed Project Report (DPR) (ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿ) ಅನ್ನು ಸಲ್ಲಿಸಿರುತ್ತಾರೆ.

ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯನ್ನು ಮೇಲ್ನೋಟಕ್ಕೆ ಪರಿಶೀಲಿಸಲಾಗಿ, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆಯ ತಾಂತ್ರಿಕ ಕೋಶದಲ್ಲಿ ನುರಿತ ತಜ್ಞರು ಇಲ್ಲದಿರುವುದನ್ನು ಮನಗಾಣಲಾಗಿದೆ. ಹೀಗಾಗಿ ಪರಿಶೀಲಿಸಲಾಗಿ, ಯೋಜನಾ ವರದಿಯ ಎಲ್ಲಾ ನಕ್ಷೆ, ವಿನ್ಯಾಸ, ಮೂಲಭೂತ ಅಂಶಗಳು ಸಮರ್ಪಕವಾಗಿದೆಯೇ ಹಾಗೂ ಈ ಯೋಜನಾ ವರದಿಯಲ್ಲಿ ಸಲ್ಲಿಸಿರುವ ಅಂದಾಜು ವೆಚ್ಚಗಳು ಸಮರ್ಪಕವಾಗಿದೆಯೇ ಮತ್ತು ವಾಸ್ತವಿಕವಾಗಿದೆಯೇ ಎಂಬ ಬಗ್ಗೆ ಸುರಂಗ ನಿರ್ಮಾಣ ಕಾರ್ಯದಲ್ಲಿ ಪರಿಣಿತಿ ಮತ್ತು ಅನುಭವ ಹೊಂದಿರುವ ಒಂದು ಸಮಿತಿಯನ್ನು ರಚಿಸಿ ವರದಿಯನ್ನು ಪಡೆದು,

. . . 2.

ತದನಂತರ ಈ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸಚಿವ ಸಂಪುಟದ ಮುಂದೆ ಮಂಡಿಸುವುದು ಹೆಚ್ಚು ಸೂಕ್ತವಾಗಬಹುದು ಎಂದು ಸರ್ಕಾರವು ತೀರ್ಮಾನಿಸಿ ಈ ಕೆಳಕಂಡಂತೆ ತಜ್ಞರ ಸಮಿತಿಯನ್ನು ರಚಿಸಿ ಆದೇಶಿಸಿದೆ.

ಸರ್ಕಾರಿ ಆದೇಶ ಸಂಖ್ಯೆ: ನಅಇ 34 ಎಂಎನ್ ವೈ 2024 (ಇ)
ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 07-04-2025.

ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ ವಿವರಿಸಿರುವ ಅಂಶಗಳ ಹಿನ್ನಲೆಯಲ್ಲಿ, ಈ ಕೆಳಕಂಡಂತೆ ಸಮಿತಿಯನ್ನು ರಚಿಸಿ ಆದೇಶಿಸಿದೆ.

1	ಶ್ರೀ ಸಿದ್ದನಗೌಡ ಹೆಗ್ಗಾರೆಡ್ಡಿ ಕಾರ್ಯಕಾರಿ ನಿರ್ದೇಶಕರು (ಸಿವಿಲ್), ಬಿ.ಎಂ.ಆರ್.ಸಿ.ಎಲ್. ಮೊ.ನಂ. 9448287975	ಅಧ್ಯಕ್ಷರು
2	ಶ್ರೀ ಮಾಧವ, ಮುಖ್ಯ ಅಭಿಯಂತರರು, ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ. ಮೊ.ನಂ.9448270489, 9844261193 ಇ-ಮೇಲ್: madhav5263@yahoo.com	ಸದಸ್ಯರು
3	ಕ್ಯಾಪ್ಟನ್ ವಿನೋದ ಶುಕ್ಲಾ, ಸುರಂಗ ತಜ್ಞರು ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, FGS Engineers E-1303, Maxblis White House-II, Sec-75, Noida ಮೊ.ನಂ. 8586971820 ಇ-ಮೇಲ್: vinodshukla25@gmail.com, Vinod.shukla@fgsengineers.com	ಸದಸ್ಯರು
4	ಮೇಜರ್ ಅಶ್ವಥ್ ಕುಮಾರ ಬಿ., ಹೆದ್ದಾರಿ ಮತ್ತು ಸುರಂಗ ತಜ್ಞರು, ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಲಾರಾ ಟೆಕ್ ಇಂಜಿನಿಯರಿಂಗ್ ಸರ್ವೀಸ್ ಪ್ರೈ.ಲಿ., #911, ಡಿ-ಬ್ಲಾಕ್, 16ನೇ ಕ್ರಾಸ್, 10ನೇ ಮೈನ್, ಸಹಕಾರನಗರ, ಬೆಂಗಳೂರು – 560092 ಮೊ.ನಂ. 9900966007	ಸದಸ್ಯರು
5	ಶ್ರೀ ಧನಂಜಯ, ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ಬಿಬಿಎಂಪಿ., ಮೊ.ನಂ. 9845208023	ಸಮನ್ವಯಕಾರರು

...3.

ಸಮಿತಿಯ ಕಾರ್ಯವ್ಯಾಪ್ತಿ:

1) ಬೆಂಗಳೂರು ನಗರದ ರಾಷ್ಟ್ರೀಯ ಹೆದ್ದಾರಿ 7 ರ "ಹೆಬ್ಬಾಳ ಮೇಲ್ಸೇತುವೆ (ಎಸ್ಟೀಮ್ ಮಾಲ್) ಪ್ರದೇಶದಿಂದ ಹೊಸೂರು ರಸ್ತೆಯ ಸಿಲ್ಕ್ ಬೋರ್ಡ್ ಜಂಕ್ಷನ್‌ನ ಮೇಲ್ಸೇತುವೆ ವರೆವಿಗೂ" ವಾಹನ ಸುರಂಗ ಮಾರ್ಗ (Urban Tunnel) ನಿರ್ಮಿಸಲು ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿ (DPR) ಯನ್ನು ಪರಿಶೀಲಿಸಿ ಎಲ್ಲಾ ವಾಸ್ತವಿಕ ಘಟಕಗಳನ್ನು (Components) ಹಾಗೂ ಅಂಶಗಳನ್ನು ಸಮಗ್ರವಾಗಿ ಒಳಗೊಂಡಿದೆಯೇ ಎಂಬುದನ್ನು ಪರಿಶೀಲಿಸುವುದು;

2) ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯು ಅನಗತ್ಯವಾದ / ವಾಸ್ತವಿಕವಲ್ಲದ ಯಾವುದಾದರೂ ಅಂಶಗಳನ್ನು ಒಳಗೊಂಡಿದೆಯೇ ಎಂಬುದನ್ನು ಪರಿಶೀಲಿಸುವುದು.

3) ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯಲ್ಲಿ ಅತ್ಯಂತ ಅವಶ್ಯಕವಿರುವ ಯಾವುದಾದರೂ ಅಂಶಗಳನ್ನು ಬಿಟ್ಟು ಬಿಡಲಾಗಿದೆಯೇ ಎಂಬುದನ್ನು ಪರಿಶೀಲಿಸುವುದು.

4) ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯು ಅವಶ್ಯಕವಿರುವ ಎಲ್ಲಾ ನಕ್ಷೆ, ವಿನ್ಯಾಸ, ಮೂಲಭೂತ ಅಂಶಗಳನ್ನು ಒಳಗೊಂಡಿದೆಯೇ ಹಾಗೂ ಅಂದಾಜು ವೆಚ್ಚಗಳು ಸಮರ್ಪಕವಾಗಿದೆಯೇ ಎಂಬುದನ್ನು ಪರಿಶೀಲಿಸುವುದು.

5) ಇನ್ನಿತರ ಸಲಹಾತ್ಮಕ ಶಿಫಾರಸ್ಸುಗಳಿದ್ದಲ್ಲಿ ನೀಡುವುದು.

ಮೇಲ್ಕಂಡ ಸದಸ್ಯರನ್ನೊಳಗೊಂಡ ಸಮಿತಿಯ ಸಮನ್ವಯಕಾರನ್ನಾಗಿ, ಶ್ರೀ ಧನಂಜಯ, ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ, ಇವರನ್ನು ನೇಮಿಸಲಾಗಿದೆ. ಸದರಿ ಸಮಿತಿಗೆ ಅಗತ್ಯವಾದ ಸೌಲಭ್ಯಗಳು, ಸಮಿತಿಯು ಕೋರುವ ಅಗತ್ಯ ಮಾಹಿತಿ ಮತ್ತು ಸಂಬಂಧಪಟ್ಟ ಎಲ್ಲಾ ದಾಖಲೆಗಳನ್ನು ಒದಗಿಸುವಂತೆ ಮುಖ್ಯ ಆಯುಕ್ತರು, ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ ಇವರಿಗೆ ಸೂಚಿಸಿದೆ.

ಸದರಿ ಸಮಿತಿಯು ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆಯು ಸಲ್ಲಿಸಿರುವ ಸವಿಸ್ತಾರ ಯೋಜನಾ ವರದಿಯನ್ನು ಪರಿಶೀಲಿಸಿ, 3 ವಾರದೊಳಗೆ ವರದಿಯನ್ನು ಸಲ್ಲಿಸುವಂತೆ ಆದೇಶಿಸಿದೆ.

ಈ ಸಂಬಂಧ ಗೌರವ ಧನ, ಭತ್ಯೆ ಮತ್ತು ಶುಲ್ಕಗಳನ್ನು ನೀಡುವ ಕುರಿತು ಪಾಲಿಕೆಯು ಕ್ರಮವಹಿಸುವುದು.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆಜ್ಞಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

(ಲಕ್ಷ್ಮೀಸಾಗರ್ ಎನ್.ಕೆ.)
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ,
ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ (ಬಿ.ಬಿ.ಎಂ.ಪಿ-1)

ಇವರಿಗೆ:

1. ಮಹಾಲೇಖಪಾಲರು, ಲೆಕ್ಕ ತಪಾಸಣೆ/ಲೆಕ್ಕಪತ್ರ, ಕರ್ನಾಟಕ ಬೆಂಗಳೂರು.

. . . 4 .

2. ಮುಖ್ಯ ಆಯುಕ್ತರು, ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ, ಬೆಂಗಳೂರು.
3. ಶ್ರೀ ಸಿದ್ದನಗೌಡ ಹೆಗ್ಗಾರೆಡ್ಡಿ, ಕಾರ್ಯಕಾರಿ ನಿರ್ದೇಶಕರು (ಸಿವಿಲ್), ಬಿ.ಎಂ.ಆರ್.ಸಿ.ಎಲ್., ಮೊ.ನಂ. 9448287975.
4. ಶ್ರೀ ಮಾಧವ, ಮುಖ್ಯ ಅಭಿಯಂತರರು, ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ. ಮೊ.ನಂ.9448270489, 9844261193, ಇ-ಮೇಲ್: madhav5263@yahoo.com
5. ಕ್ಯಾಪ್ಟನ್ ವಿನೋದ ಶುಕ್ಲಾ, ಸುರಂಗ ತಜ್ಞರು, ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, FGS Engineers, E-1303, Maxblis White House-II, Sec-75, Noida, ಮೊ.ನಂ. 8586971820, ಇ-ಮೇಲ್: vinodshukla25@gmail.com
6. ಮೇಜರ್ ಅಶ್ವಥ್ ಕುಮಾರ ಬಿ., ಹೆದ್ದಾರಿ ಮತ್ತು ಸುರಂಗ ತಜ್ಞರು, ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಲಾರಾ ಟೆಕ್ ಇಂಜಿನಿಯರಿಂಗ್ ಸರ್ವೀಸ್ ಪ್ರೈ.ಲಿ., #911, ಡಿ-ಬ್ಲಾಕ್, 16ನೇ ಕ್ರಾಸ್, 10ನೇ ಮೈನ್, ಸಹಕಾರನಗರ, ಬೆಂಗಳೂರು – 560092, ಮೊ.ನಂ. 9900966007.
7. ಶ್ರೀ ಧನಂಜಯ, ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ಬಿಬಿಎಂಪಿ., ಮೊ.ನಂ. 9845208023.
8. ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ವಿಕಾಸಸೌಧ, ಬೆಂಗಳೂರು.
9. ಸರ್ಕಾರದ ವಿಶೇಷ ಕಾರ್ಯದರ್ಶಿ ರವರ ಆಪ್ತ ಸಹಾಯಕರು, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ವಿಕಾಸಸೌಧ, ಬೆಂಗಳೂರು.
10. ಶಾಖಾ ರಕ್ಷಾ ಕಡತ/ಹೆಚ್ಚುವರಿ ಪ್ರತಿಗಳು.

6.2 ANNEXURE 2 – Clarifications sought from DPR consultant

Consultancy Services for Review of DPR for Construction of Underground Vehicular Tunnel from Hebbal Esteem Mall Junction to Silk Board KSRP Junction DPR REVIEW COMMENTS - ROADS AND TRAFFIC							
Sl. No.	**Document / Vol**	**Para / Page Ref**	**Brief Item**	**Detail particulars**	**Remarks (Observation by Review committee dt. 17April2025)**	**Reply by DPR Consultants (27Apr2025)**	**Response by Review committee (28Apr2025)**
A.	**DPR - Main Report; Vol-I**						
1	Executive Summary	Para-1.2 / Page-21	Traffic study & Forecast	Reference from CMP 2020 (by BMRCL and DULT) has been taken to integrate traffic studies and simulations for forecasting the future demand model.	Details of projects planned & implemented under CMP2020 and its references to option studies conducted during Feasibility study / DPR preparation be furnished in the Report to validate the recommendation for tunnel Road as brought out in Feasibility study Report.	Chapter 4 of DPR mentions the details of the projects taken into consideration. Some of them include Satellite Town Ring Road, Peripheral Ring Road, Inner Ring Road, upcoming phases of Namma Metro, etc.	The implication of those projects on the projected Traffic volume figures including traffic mode diversions of each is not furnished. Same is recommended to be furnished in a tabulated format
2		Para 1.3 / Page-21	Need for Tunnel	The present LOS is indicated as E/F but what is the proposed / Design LOS is not indicated.	However, Table -18 in Page-47 indicates varying LOS of B/C/D.	Table 18-19 of Executive Summary and Table 68 of the Main Report, describes the Proposed LOS	The proposal in Table-19 indicates proposal of varying LOS from LOS - A to LOS-C in 2027-28, LOS-A to LOS-D by year 2041 & LOS- A to LOS-F by 2051 while LOS-B is desirable and LOS-C may be acceptable during the Design period.

3				Year wise traffic projections along the proposed corridor duly considering the competing modes of transport under completion and the year in which the proposed tunnel Road would reach its capacity couldn't be found. Traffic diversion due to Bengaluru Suburban Railway, Metro rail around the project corridor considered for planning & design may please be furnished.		Table 76 describes the LOS in the proposed corridor for the years 2047-48, 2051 and 2057-58. LOS F is observed in Section 2 (Towards Bengaluru) in 2047-48 and till 2057-58, Ramp F, K, M and V are also observed to be at LOS F. As per the Modal Share in CMP, the public transport travel pattern is considered while estimating the horizon year trips.	As per para 7.7.1 (Page-119 of Main Report), the current modal Share of Cars is just 21% and public transport is 47.8% (Source: CMP-2020). Whereas, as per Fig 66: Overall Avg. traffic composition (Page-125 of Main Report) the actual Share of Cars & Taxis is 38% and Bus is only 3% as per traffic survey carried out during DPR preparation. Considering such huge variance, it is advisable to consider the latest figures as per the DPR and make necessary projections with due consideration for traffic diversion due to proposed Public transport systems like METRO / RTS / EV buses etc..
4		Para-1.5.2 / Page-33 of 269.	Table 5: Ramps Details & lane configuration	Intermediate lane configuration is proposed for entry & exit ramps at Palace Ground/Mekhri Circle. whereas, As per IRC SP 87-2019 minimum of two lane configuration should	Intermediate lane would not only hinder smooth movement of traffic and cause delay but also causes high risk of traffic stagnation till evacuation incase of any breakdown of any vehicle.	Due to consideration of land acquisition, intermediate lane is proposed. However, if land is acquired, two lane ramps should be provided.	Considering long term perspective, it is recommended to make provision for minimum of two lane configuration for entry & exit approach ramps. As Land acquisition is being made for Intermediate lane, a small additional extent of area for

				be provided for entry and exit ramps.			providing two lane configuration should not be a major issue.
5		Para1.5.2&1.5.3 Page-30 to 38	Salient features of Entry / Exit Ramps	It is observed that the Total length of all the approach Entry / Exit Ramps is approx.17.25Kms.	Adequate measures to be taken for timely land acquisition.	Noted	LAQ Plan & schedules couldn't be noticed in DPR.
6		Para 1.6 / Page-30	Tunnel Lane configuration	What is the capacity of tunnel considered to arrive at the requirement of 6 lane configuration?		Chapter 7.19 describes the capacity of tunnel, 6900 PCU/Direction in Peak Hour	As discussed, No of Cars & No of EV Buses projected over the Design period be brought out in a tabulated format for ease of understanding by general public, public reps & various stake holders.
7		Para-1.6 / Page-30	Present Service Level / Traffic Speed	The travel time will be reduced from about 90 minutes to 35 minutes and Level of Service will enhance from existing LOS of E and F to LOS of B and C.	i.e Traffic Avg Speed expected to be achieved is only 29Kmph.	Noted	OK

8		Para-1.6.7 / Page-39	Traffic Survey at Site	Based on the Traffic survey data analysis, can we distinguish and quantify (a) Normal traffic (b) Diverted traffic and (c) attracted traffic along the proposed corridor for minimum of 20 years after the project completion period. The floating population should also be considered in the traffic projection.		Table 55 in Chapter 7.9.2 describes the existing volume and level of service of existing traffic.	Table-55 doesn't classify / provide break up of Normal traffic, Diverted traffic and attracted traffic. LOS does not provide specific traffic volume. As such recommended to provide Mode wise traffic volume projection figures of proposed corridor for minimum of 25 years on project completion period as we discussed.
9		Para 1.5.2.1 / Page 32 of 269	Table 3: Brief Details of Pkg-1 & Figure 6: Entry and Exit at Hebbal Junction	While the proposal for entry & exit ramps from existing main carriageway & service roads for free traffic movement has been indicated, the alignment of METRO line alignment, Urban rail under construction and any other development plans be		Considered during alignment finalization process.	OK

				indicated to avoid possible conflict.			
10		Para1.6.13 / Table-17, Page-46 of 269	Traffic modelling and LoS along the project alignment	The projected traffic for the years 2031 and 2041 presented in Table-17 may be substantiated with year wise traffic forecasting approach.		Chapter 7.13.2 describes the detailed methodology adopted for traffic projections.	While the methodology is explained, the Figures be furnished in a tabular form for ready reference as discussed.
11		Para1.7.7 / Page-64 of 269	Table -24 : Geometric Design Criteria	Lay byes to cater for any vehicle break down within the tunnel hasn't been provisioned.	As per IRC SP 87-2019, it is recommended to provide Layby inside Tunnel at 750 m Interval. Pl clarify.	It is difficult to provide Lay Byes in TBM methodology of construction. However Extra lane is provided at the Intermodal hubs.	The Inter modal hubs are around 4Kms interval, Alternative arrangements is to be provisioned for timely & safe recovery of such vehicle.
12		Para1.8 / Page-67 of 269	Pre Construction activities / Land Acquisition	Land Acquisition : As the Alignment plan of all the entry exit ramps, multimodal hubs & TBM shaft locations have been finalized, LAQ Plan & Schedule be finalized on priority with break up of Govt & Pvt lands for timely notification.	As LAQ would have direct bearing on Project schedule, priority action is recommended.	Noted	As per para 2.1(k), page -73, preparation of LAQ Plan & Schedule is part of scope of work of DPR, same be furnished for timely action by client/ GoK.

13			Utility shifting	Utility shifting plan with details of Utilities like water line, UGD, Power cable, telecom cable / OFC etc... identified for shifting along with schedules be furnished & realistic estimate be worked out.	As Utility shifting plan would have direct bearing on Project schedule, priority action is recommended.	Utility shifting cost has been considered on Lump sum basis at DPR stage.	As per para 2.1(l), page -73, preparation of Utility Relocation Plan & Schedule is part of scope of work of DPR, same be furnished for timely action by client/ GoK.
14			Tree Relocation	The details of trees identified for relocation / cutting be furnished after joint inspection with Forest Dept officials and work out realistic costing.	As Tree cutting / re location plan would have direct bearing on Project schedule, priority action is recommended.	This would be done at the execution stage by the concessionaire.	As per para 2.1(i), page -73, preparation of Environment impact Assessment (including Tree enumeration & relocation Plan & Schedule) is part of scope of work of DPR, same be furnished for timely action by client/ GoK.
15		Para 7.5 / Page-116 of 269	Vehicle Growth in city	The growth factors for each class of vehicle during the last 20 years be considered and forecast their growth for the next 20 years so as to arrive at the realistic vehicle growth projection		Chapter 7.13.2 describes the detailed methodology adopted for traffic projections.	It only describes the detailed methodology but traffic figures not furnished. As such recommended to furnish the traffic projection figures in a tabular format as discussed.

				instead of taking average growth of 8%.			
16		Para 7.8.2 / Page-120 of 269	Table 48 - Comparison of Travel Characteristics.	The current mode share by different classes of vehicles is to be considered and forecast the same instead of taking the values of CMP 2020 as it would also validate the mode share and help in realistic projections.		Chapter 7.13.2 describes the detailed methodology adopted for traffic projections. The existing modal share has been considered for projections.	It only describes the detailed methodology but traffic figures not furnished. As such recommended to furnish the traffic projection figures in a tabular format for ready reference as discussed.
17		Para 7.13.1 / Page-145 of 269	Key Assumptions	While the key assumptions made for travel demand forecasting appears to be based on CMP 2020, the same is to be validated based on the Traffic survey & demand assessment and justify the values adopted from the CMP for the present project as per the scope of		Chapter 7.11 discusses the detailed methodology adopted for base year model development and validation of the same through observed traffic collected during traffic surveys.	It only describes the detailed methodology but traffic figures not furnished. As such recommended to furnish the traffic projection figures in a tabular format for ready reference as discussed.

				work stipulated in para 2.1 (a) in page-73.			
18		Para 7.10.3 / Page-134 of 269	Fig-72: Purpose wise Trip distribution	The Pie chart indicates highest share of 69% for work related trips. What is it's implication on diversion due to Metro / other competitive modes based on the OD studies ? Hope that has been analyzed for and factored for in projections accordingly. Same is to be clarified and confirmed.		Chapter 7.13.2 describes the detailed methodology adopted for traffic projections. The existing travel pattern has been considered for projections as well. Table 59 prescribes the validation the existing traffic data.	It only describes the detailed methodology and overall peak hour PCU / Level of service (LOS) but doesn't reflect the figures of peak hour volume of cars & EV Buses. As such recommended to furnish the projected Peak hour figures of Cars & EV buses in a tabular format for ready reference as discussed.
19	General Comments on traffic forecast		Sample size of traffic studies	The size of the sample traffic volume count , OD survey, Speed and delay studies, Willingness to pay toll studies (Number of days) done along the project corridor and it's record is not furnished in report to justify the		Chapter 7.9 discusses the primary survey details and the number of locations covered under each type of survey.	Chapter 7.9 doesn't reflect whether the Traffic volume survey was carried out for 7 days to capture traffic flow pattern / variation on week end / holidays. similarly for OD survey & Speed and delay studies, Willingness to pay toll studies done along the project corridor.

				projections. same could be furnished.			
20			Mode Share	The mode share by metro and the influence of metro & other MRT system on the proposed mode share and traffic forecast couldn't be found. Same is to be furnished.		Chapter 7.12.3 discusses the modal share adopted for horizon years and also considers the future development of MRT systems.	Chapter 7.12.3 indicates the mode share in % as per CMP 2020, but doesn't reflect whether the same is validated based on Traffic studies carried out during DPR preparation and projections of mode share of cars & buses duly accounting the values of traffic diversions for are made due to METRO & MRT system accordingly.
21	Main Report		General	Method of construction	The reason for selecting Tunnel Boring Machine (TBM) as the construction method has not been explicitly stated.	Preference of TBM tunnelling for the standard section of main tunnel is made to minimize the risk related to tunnel excavation. However use of TBM is restricted by ground cover and possible cross- section and therefore other tunnelling methods i.e. U/G ramp, Cut & Cover, NATM tunnels have also been considered in the project based on the feasibility.	This aspect may be covered in report
22					Detailed construction schedule not provided	Detailed construction schedule in the bar chart is available and attached with the replies	Not available

23					Need more clarity on drainage scheme provided	Overall drainage scheme is explained in the drawing. (RC/1640/HO/HBT/TU/DWG/GEN/ALG/111 to 113)	The locations of sumps proposed are not matching with the valley locations. The Design calculations and sizing are not available.
24		Pg. 47			Traffic projection for 2041 seems to be low. So clarification needed for type of vehicle through the proposed underground tunnel.	The analysis is done till the year 2057/58 which is shown at the table 76 of Main Report shows the LOS calculation for Peak Hour for the project corridor.	
25		Cl. 1.7.1			Latest CRRI speed specifications need to be checked for assessing design speed	The design speed is 80 Kmph for the main tunnel has been adopted in consultation with BBMP, traffic volume and the requirement of Level of Service (LoS).	Query not addressed
26		Cl. 1.7.2		TBM section will be modified using NATM technique to accommodate additional lanes at entry/ exit intersections.	An assessment should be conducted to determine the feasibility of employing this method in softer rock formations. Also the methodology after segments are fixed.	There are examples available for enlargement of tunnels by removing the segmental lining and side-slashing of tunnels in urban environment. The exact methodology and support scheme shall be developed by the concessioner during detailed design.	The methodology of widening the cross section and cutting for making cross passages by dismantling the concrete segments is crucial requirement in DPR. This needs to be addressed.

27		Cl. 1.7.2.1		The NATM Tunnel has been proposed in the ramps location to make the project cost effective.	Is it due to cost effective or construction convenience due to curve	Use of TBM in ramp sections is ruled out mainly due to non-standard sections construction challenges. The other possible method of construction is cut & cover, however challenges related to land acquisition, complexity of junctions with TBM tunnel, increasing ground cover and impact to the third party structures does not favor the C&C option along the entire ramp.	Ok. Query is closed
28					Lay bye's are provided in fig 21 & 22	Fig. 21 and 22 of the DPR refer to the cross passages.	Ok. Query is closed
29					Need clarification on safety precautions in case of breakdown	Tunnels are to be managed by traffic management system i.e. closure of lane or the entire tube or both tubes is possible. The bus lane/ emergency lane is available to access and attend any breakdown vehicle inside.	There has to be a well-crafted strategy to maintain fluid traffic movement inside the tunnels and ramps. Assuming high traffic volume and the possibility of slow traffic, congestion and vehicular breakdowns have to be considered.
30					Clarification is required on traffic management when ramps gets congested.	Typical large distance between entries/ exits would suggest a smooth flow of traffic inside the main tunnel and that in turn should minimize any pile-up of	There will be severe traffic congestion at the ramps, consequently extending into the tunnel in the event of vehicle breakdowns. Methods of tackling

						vehicles at entries in normal operation.	traffic congestion in ramps and tunnels due to change in speed and other reasons are also to be explained.
31					Is any precautions taken during flooding.	Detailed design of concessioner shall cover the sizing of sump and drainage system to meet various scenarios of water ingress. From the safety point of view tunnel should not be used for traffic during any flooding situation. Prevention of tunnel flooding should include any adjustment of vertical alignment at entry/ exist during the detailed design by concessionaire	The city is prone to sudden flooding of roads and the method of preventing water flow into the tunnel and handling the situation, along with cost estimates are to be a part of the DPR.
32	Main Report	Cl. 8.9.1 Pg.210	General		Refuge parking scheme is not clear	For the breakdown vehicles, handling SOP shall be prepared by the concessionaire taking into account bus lane. The extreme left lane in the shaft shall be used for refuge parking.	This implies that only one refuge parking is available in every 4km. In case of breakdown of a vehicle in between, the whole traffic in the tunnel tube will be congested.
33		Pg. 207 (fig 135)			How is the merger section excavated ? Too large c/s.	Refer point 6 above	Ok. Query is closed

34		Pg. 211			Explain intermodal hub	Intermodal hub is the location marked at the location of TBM lowering and extraction shafts. These will be developed after the TBM is extracted. A conceptual layout is prepared at DPR Stage that inter modal hubs will accommodate the operation office for tunnel and allied services, ventilation ducts, parking spaces, retail spaces etc.	Ok. Query is closed
35		Pg. 227		Project implementation schedule	Only tentatively provided. No detailing in this regard.	Refer point 2 above	The detailed schedule is still not available
36		Pg. 233		Estimate	Typo on the cost of TBM: 589 Cr	Noted	Ok. Query is closed
37					Clarify if any risk matrix is prepared	Various risk related to construction of project are explained in the GIR	Risk matrix pertaining to operational phase has to be made.
38					Please explain why horizon year is taken as 2041.	The Horizon Year 2041 has been decided in consultation with BBMP.	
39					Structural sufficiency, riding comfort etc over the years for carriageway in tunnel part is to be checked.	It is part of the detailed design and will be dealt by the Concessionaire.	Implications of cost cannot be attributed to the bidder

40					Providing fire hydrant pipes on walkways are not clear. How the pipes will cross the cross passage, how the fire fighters can reach the hydrants placed on emergency walkway?	It can only be addressed by the Concessionaire at the time of detailed design resolving conflicts and interface issues. The scenario of emergency with regard to fire in the sections between the ventilation stations is dealt with under section 1.10 of the Ventilation Design Report of DPR. The SOP in this regard will be developed by the Concessionaire at the time of detailed design.	The cost implications for these have to be addressed to provide clarity in bidding stage.
41					Sprinkler system not recommended by PIARC.	As the tunnel is located in urban environment and considering the length of tunnel which is more than 3 km and the traffic flow conditions, the tunnel falls in category AA (Figure 9.2) defined in IRC_SP-91 (section 9.5.2), for which sprinkler in fire fighting equipment are mandatory as per Table 9.1.	Please refer comment to Sl. No. 13 of Tunnel Ventilation & Firefighting section under E&M
42					Explanation is required for fire fighting systems in ramps and tunnel	Both have same fire-fighting mechanism. Details are available in ventilation design report, section 1.9	Not sufficiently clarified

43					SoP for emergency conditions are missing	Details are given in ventilation design report, section 1.10 (emergency and evacuation)	Emergency response philosophy proposed for the ramps in the report needs to be relooked.
44	Main Report and Drawings	pg 129 of drwg pdf	Cross sectional elements	TCS at Cross Passage	No drain provision is shown. As there will be tunnel washing water and other spillages from vehicles will be there, drainage shall be given.	Refer drawing no. RC/1640/HO/HBT/TU/DWG/NT/RCS/402 for regular cross section of Cross passage, that shows the drainage provision.	Ok. Query is closed
45		pg22 of dwg pdf		TCS Main TBM Tunnel	Drain at Left side only. However, connection of utility duct at right side to main collection drain is shown.	Refer Note 3 in RC/1640/HO/HBT/TU/DWG/BT/RCS/301 for clear understanding. The drain should be provided based on the cross gradient of pavement.	Ok. Query is closed
46		pg 22 to 37 dwg pdf		Typical cross section (TCS)	Walkway shown at one side only. As per IRC SP 91, two footpaths shall be given per tunnel tube. However, in Note 4 it is written, walkway can be planned on either side of the road as per detailed design. Width of walkway in dwg - 750mm. As per IRC SP 91- Min. 1.5 m including railings. IRC SP	The recommendation of SP-91 is not fulfilled in the respect and remain as deviation. Notably for unidirectional tunnel provision of one side footpath of 750mm is considered sufficient for overall optimization of tunnel cross section.	A separate statement of deviations from codes and guidelines shall be included under Schedule D.

					91- Annexure B, Clause 2.2, point 2 e).		
47		pg 22 to 37 dwg pdf		Typical cross section	Please mention clearly about drainage system top covering	Concessionaire to provide the manhole cover meeting the project specifications.	Ok. Query is closed. However, technical specifications need to be provided.
48	Main Report and Drawings	pg 22 to 37 dwg pdf	Cross sectional elements	Typical cross section	Connection of drainage in transition from TBM to NATM, C&C, Open Ramp are not clear.	Tunnel water for entry/exits is collected in drain and flow under gravity. The water is subsequently collected in the central drain running in the utility gallery of TBM tunnel which will drain in the sumps (located in the cross passages). From sumps the water will be pumped to discharged through shafts.	Calculations not provided
49				Typical cross section	Edge distance not properly maintained.	Edge distance is provided on one side where was crash barrier is provided on the other side. Also refer the reply in point 26 above.	Ok. Query is closed

50	Geotechnical Design Report	Pg. 289	Design	Pile capacity calculations	Allowable bearing capacity calculations based on factor of safety is not clear	Secant piles as part of earth retaining structures to take care of lateral load mainly. They will be socketed in good rock for case the bearing capacity is not a design concern, nevertheless a short check of end bearing of pile is conservatively estimated to compare with the axial force at pile toe	Ok. Query is closed
51	Structural design report	7.3.2: Pg. 30, 5.3.2: Pg. 20		Structural design of Cut & Cover and NATM enlarged intersections	Temperature load and shrinkage & creep is not considered.	DPR design is done to cover the preliminary calculation to arrive at sizing and cost estimation. The detail design by concessioner shall cover the further details	In the design the same to be considered
52	Geotechnical Interpretative Report	Appendix II of GIR	Geology	Geotechnical Investigation	1) Borehole number or location details has not been provided in the bore log data in GIR. Please provide these details, so as to correlate the borelog with the alignment.	Refer the revised GIR, attached with the replies	The revised GIR and details of all boreholes are not received.
53					2) It would be better to understand the exact lithological conditions of the ground, if all boreholes are completed.	Refer the revised GIR, attached with the replies	Not provided

54				Geophysical Investigation	The region has high risk of encountering groundwater table and aquifer zones. Why not conduct electrical resistivity tomography, to identify such regions?	Sufficient investigation data is available from DPR investigation (boreholes) and secondary sources to know about the ground water condition along the alignment. Also the experience of metro tunnels has been considered to evaluate the risks related to any weak zone along the alignment with high seepage and its mitigations. The choice and design of TBM is the most important aspect for mitigation of such risk. Further during tunnelling regular probing for strata ahead of the tunnelling shall be done by the concessioner.	Aquifer details are not considered in any report. This is a high risk item for tunnelling.
55		pg 38 of GIR		Geotechnical Risks	1) Since the probability of encountering mixed grounds/ high soil fill areas are present, how is this issue going to be tackled during tunneling.	A suitable design of TBM, for the main tunnel should take care of such risk. The proposed slurry type TBM would be quite useful in managing such risk.	Ok. Query is closed

56					2) Bangalore city has high risks of flash floods and water logging. What preventive measures have been proposed to tackle this issue? Is it been incorporated in the design?	Refer point 16 above.	Reply cited above is not fully addressing the issue raised.
57					3) Since the city faces water scarcity, from where is the water for construction acquired?	The water for construction purpose will be sourced as is being done for other infrastructure works in the city such as Metro and flyovers.	Ok. Query is closed
58	Main Report	1.1,73 of 325, 255 of 325	Constructi on period	6 months for MEP works has been allotted; Total time frame for E& M and ventilation works is expected about 20 months. However, a major portion of this shall be taken up parallel to TBM drive. After completion of TBM drive, 6 months' time frame is required to	What is the basis to assume that 6 months are enough?	Considering the large cross sections and various entry/ exits available, the MEP works are expected to e executed concurrently with the tunnelling work. With this consideration, the timelines of MEP works are achievable.	Ok. Query is closed

				complete the in all respect			
59	Main Report	8.8,233 of 325	Tunnel drainage system	The tunnel drainage system has been provided to cover all sorts of water which may reach the tunnels such as road surface spillage, cleaning water, ground water seepage, firefighting or rainwater etc. It is important to control the spills at source level, however, tunnels cannot be assumed dry at all times. Therefore, continuous drainage shall be provided to collect those water and channelize it to the designated sumps from where it can be mechanically discharged to nearest municipal drains	Oil interceptor with hydrocarbon gas detection not prescribed anywhere in the report	Oil interceptors have not been recommended to be included in the tunnel as permitted vehicles in the tunnel will not be creating any spillage of oil. Moreover, no fuel tankers are supposed to use the tunnel.	Petrol and diesel cars pose the possibility of oil spills. The water drained out of the tunnel has to be filtered for oil and silt before being drained out to municipal drains.

				through the project shaft.			
60			Tunnel lighting control	Not mentioned in any report	Based on tunnel category, Dimming is the recommended lighting control solution.	Yes, the Tunnel dimming strategy will be part of detailed design and will be taken care of by the Concessionaire. Such detailing is supposed to be included in the detailed design.	It is not clear whether the cost for dimming is considered in the estimate or not.
TUNNEL VENTILATION SYSTEM & FIREFIGHTING SYSTEM							
61	Ventilation design report	General	Concept of ventilation		The overall concept of the tunnel ventilation looks promising with a combination of longitudinal and transverse ventilations. However, the feasibilities of different options is not explored and the reason for discarding a particular ventilation method is not evident.	1) All ventilation system options has been explored as per IRC-SP-91 guidelines; however, based on ventilation design transverse system is found to be most suitable for the main tunnel and longitudinal ventilation system for box tunnels in approaches. 2) Details of feasibility of various ventilation systems are deliberated in ventilation design report, section 1.5 and 1.6.	Ventilation Design Report Section 1.5 describes different ventilation systems used in tunnels. Section 1.6 mentions that longitudinal ventilation is proposed for entry and exit ramps longer than 500m and main tunnel sections are proposed to have fully transverse ventilation. These sections do not explain why other schemes such as longitudinal ventilation with shafts or semi-transverse ventilation are ruled out.

62	Ventilation design report	1.5.1,11 of 46	Longitudinal	However, this system needs to be provided with intermediate shafts for massing exchange of exhaust with fresh air	The current design proposal has ventilation stations which could be used as shaft locations. Is this possibility explored?	The shaft locations are restricted by the land availability and located at about 3.5 km. Providing intermittent ventilation shafts between the shafts is not feasible due to non-availability of ground occupancy (land).	Ok. Query is closed
63	Ventilation design report	1.5.1,11 of 46	Semi transverse	This system needs to be provided with intermediate shafts for massing exchange of exhaust with fresh air more frequent than fully transverse system	The current design proposal has ventilation stations which could be used as shaft locations. Is this possibility explored?	The shaft locations are restricted by the land availability and located at about 3.5 km. Providing intermittent ventilation shafts between the shafts is not feasible due to non-availability of ground occupancy (land).	Ok. Query is closed
64	Ventilation design report	1.7.3,15 of 46	Analysis of traffic flux: vehicle categories and number of vehicles	For the present design, based on the information received from the traffic analysis, the vehicle composition is 100 % PCUs from ventilation system point of view. All are considered to be the petrol vehicles	For a city like Bengaluru with has such a wide variety of vehicle fleet, the consideration of traffic composition of 100% passenger cars plying through the tunnel doesn't seem promising. The design fire loads are also dependent on the traffic composition.There is no information regarding the traffic data considered.	The tunnel is intended for passenger cars and electric buses only. Traffic data consideration is explained in section 1.7.4 and table 16 of the ventilation design report.	Ok. Query is closed

65	Ventilation design report	1.7.4,15 of 46	Table 7 & table 8	Emission rates (g/h and m^2/h) in different sections	The emission values are seemingly estimated following the PIARC recommended standard procedure. However, the speeds at which the highest emission generation in each of the sections is not explicitly provided.	1) The emission values corresponding to 40 kmph are used. This represents highest total emission corresponding to number of vehicles passed. 2) Please refer figure 9, page number 17	This is not reflected in the report
66	Ventilation design report	1.7.6,17 of 46	Fresh air rate requirements	Based on table 11 and 12, amongst all the sections considered, the maximum fresh air rate of 325 m^3/s is required for NOx. So, this is chosen to estimate the pressure drop in the tunnel and decide the number of fans (both for longitudinal and fully transverse system)	The methodology here is agreed. However, the details on the estimation methodology of pressure drop is not very clear.	The pressure drop inside the tunnel is calculated based on PIARC 05-02-B, page number 49. This report is available in the reference.	The parameters mentioned as per this reference are based on Euro 1 and Euro 2. There are no revisions available for this document matching the update in vehicle emission standards, particularly reflecting Indian conditions.

67	Ventilation design report	1.7.7.1, 18 of 46	Longitudinal system	Pressure drop in Tunnel, Pa 183	How is the pressure drop arrived at? For longitudinal drive of air, why fan pressure rise is preferred over fan thrust?	The pressure drop inside the tunnel is calculated based on PIARC 05-02-B, page number 49. This report is available in the reference. It is a standard practice to use the fan pressure because it estimates the number of fans for required airflow rate for a given section.	Same as reply to Sl. No. 6 above
68	Ventilation design report	1.7.7.2, 20 of 46	Fully transverse system	Table 15 & Table 16	The spacing of duct openings is not considered anywhere in the design. The amount of air flow into or out of the duct also depends in the opening spacing. This in turn can influence fan sizing.	1) The duct opening and positioning is detailed in CFD analysis (section 2, ventilation design report). 2) The fan size is decided based on the air flow requirement 3) This information is also given both in Schedule D, section 8.1.5 and in drawing file "tunnel line diagram"	Not reflected in the report

69	Ventilation design report	1.7.7.3, 20 of 46	Total number of fans in different sections for normal operation	Table 17	Number of fans and the respective parameters selected in the fully transverse sections and longitudinal sections doesn't make sense of proper selection of the equipment for the purpose intended	The minimum distance between the fans with longitudinal and fully transverse calculations for different sections estimated as 118 m and 115 m respectively with minimum power requirement as 11.9 kW and 22 kW per fan respectively. Based on these numbers and considering the conservative approach, the minimum distance between the fans is considered as 115 m for all the sections designed for both longitudinal and fully transverse system. This is explained in section 1.7 of the Ventilation design report. However, at the detailed design stage it can be further optimized by the Concessionaire.	This is connected to the our reply for Sl. No.1 in Tunnel Ventilation section. The query was how the number of fans was arrived at. This stands unaddressed.

70	Ventilation design report	1.8.1,2 2 of 46	Heat release rate and fire curve	a heat release rate of 30 MW for a duration 10 (to 60) minutes is chosen for the design	IRC SP 91-2019 recommends design HRR to be 50MW minimum. The current design considers only passenger cars and electric buses which calls for low design fire loads. Fossil fuel powered buses and non-DGVs of larger sizes are strictly ignored from the design.	Tunnel is intended for passenger cars and electric buses only. HRR for passenger cars is of the order of 5-10 MW and that of electric bus as 30 MW. Therefore, HRR of 30 MW is considered for preliminary design at DPR stage.	Ok. Query is closed
71	Ventilation design report	1.8.2,2 2 of 46	Selection of appropriate ventilation system	The equipment such as jet fans should be selected such that they work at least for 90 minutes with hot air (250°C) and smoke	Jet fans shall have thermal rating for minimum 2 hours and temperature selection shall be based on fire site gas temperature.	The design fire is considered for one hour, for which 90 minutes thermal rating of fans had been considered reasonable. However, after the detailed discussion with the committee, we are recommending 2 hour thermal rating of fans.	Ok. Query is closed
72	Ventilation design report	1.8.2,2 2 of 46	Selection of appropriate ventilation system	Enough number of fans to maintain at higher power to account for loss of some fans due to fire	Redundancy/unavailability is not quantified in the design	Minimum redundancy of 10% is considered in the estimate at DPR stage. However at the detailed design stage, on the basis of RAM study, the redundancy may be required to be enhanced further, which shall be addressed by the Concessionaire.	Ok. Query is closed

73	Ventilation design report	1.9,23 of 46	Design of firefighting systems	Sprinklers	Sprinklers are found to be least effective in suppressing tunnel fires of all the deluge systems available and even impacts the tunnel ventilation system.	As the tunnel is located in urban environment and considering the length of tunnel which is more than 3 km and the traffic flow conditions, the tunnel falls in category AA (Figure 9.2) defined in IRC_SP-91 (section 9.5.2), for which sprinkler in fire fighting equipment are mandatory as per Table 9.1.	(1) We suggest considering mist system instead of sprinklers as recommended by NCHRP. There is mention of mist system in the DPR documents also. Only one system is required. (2) It is not clear whether the costing has considered both sprinkler and mist systems or only one of the two.
74	Ventilation design report	1.9,23 of 46	Design of firefighting systems	In addition, there are spot and linear heat detectors	LHD is sufficient	In the DPR recommendation, it has been mentioned that both types of detectors, LHD and Spot may be used. LHD will be used in the tunnel and spot detectors shall be used inside the duct, which has been considered in the estimate as part of ventilation system. The details of locations of detectors shall be finalized at the time of detailed Design by the Concessionaire.	Ok. Query is closed

75	Ventilation design report	1.9,23 of 46	Design of firefighting systems	Fire alarms are recommended to be placed at every 100 m while the fire alarm sensor at every 20 m	Fire alarms to be provided as per IRC standards	Fire alarm Distances are selected based on the Section 7.4.6.6.4 document NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways which provides that the fire detector captures fire up to a distance of 15meters. Section 14.11.2 of IRC SP 84 provides that the Fire Detector should be placed at 25m spacing. Considering the traffic and tunnel in urban area, we recommend a spacing of 20m. This meets the requirements of both the standards and permits some redundancies.	Query not addressed
76	Ventilation design report	1.9,23 of 46	Design of firefighting systems	The maximum distance between fire extinguishers of 90 meters	Fire extinguishers to be placed as per IRC recommended spacing	Distances between the two adjacent fire extinguishers are selected based on the Section 7.9 of document NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways, which provides a spacing of 90m. annexure B Section 8 of IRC SP 91-2019 provides for a spacing of 100m. Therefore, the recommendation in the DPR complies the minimum	Ok. Query is closed

						requirements of both the Standards.	
77	Ventilation design report	1.9,23 of 46	Design of firefighting systems	This standpipe should have a minimum capacity of 1000 l/min at 0.5 Mpa.	There is a deviation of operating pressure in the considered design for standpipe from the recommended standards accepted worldwide	Recommendation is given based on the Section 6.3.3.3 of the document PIARC 3860 which recommends that the standpipe should have a minimum capacity of 1000 l/min at 0.5 Mpa.	It is recommended to follow NFPA norms instead of PIARC
78	Ventilation design report	1.9,23 of 46	Design of firefighting systems	The standpipes can be either wet or dry.	Type to be fixed	Wet pipes are recommended for the sprinklers and dry pipes for hose connections.	Full wet pipe system is recommended
79	Ventilation design report	1.9,23 of 46	Design of firefighting systems	The between hose connections is recommended to 85-90 meters	Hose connections spaced at location different from IRC recommendations	The IRC reference has not been mentioned in the observation. We are unable to connect the provision to a clause of IRC Codes. However, the distance between two adjacent hose connections is recommended based on the Section 10.4 of document NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways, which provides for 85 m spacing between two adjacent hose connections and maximum 45m from any point to the nearest hose connection. Therefore, a range of	Please refer Chapter 14, IRC SP 87: 2019

						85m to 90m has been recommended in the DPR.	

80	Ventilation design report	1.12,26 of 46	Recommendation for the whole tunnel ventilation system	The maximum flowrate for the fans has to be increased by 15 % and the power by 30 % keeping the distance between them same	The recommended variations vide above observations shall lead to a reduction in the overall power requirement as per our experience.	These power requirements are for the emergency scenario, which are normally not optimized, considering the safety of the road user. It may be noted that the flowrate for the fans required during fire may be higher, it results in higher requirement of power. The power requirement is proportional to the square of the flowrate. So the increase in power requirement will be of the order of 30% for increase in flowrate by 15%. However, for smoke stratification the flowrate may be required to be cut down, leading to reduction in power requirement. For flowrate estimation, please refer provisions of IRC SP 91 2019 Section 5.9.1 and for power estimation section 4.2.2 of PIARC Tunnel Manual 05.02.B.	Ventilation fans are selected for a fixed maximum flow rate and power which will be at 100% loading. The consideration of rise in power consumption wrt the flow rate shall be less than the maximum values.

81	Ventilation design report	1.12,27 of 46	Recommendation for the whole tunnel ventilation system	Table 21	The equipment selection vide this table and the previous tables does not tally up the requirements from the operational and maintenance perspective.	The equipment selection vide the table 21 are consistent with table 17. There are 508 fans for transverse ventilation and 216 fans for longitudinal ventilation which put together with the 26 fans for cross passages sum up to 242. Additional requirement for O&M is considered in costing @10%.	Calculation for number of fans not available
82	Ventilation design report	1.12,27 of 46	Recommendation for the whole tunnel ventilation system	Figure 16	Fire hydrant pipe, fire alarm, water mist nozzle, LHD cable and jet fan are not seen in the drawing.	Correction will be made in the figure for the missing information.	Ok. Query is closed
83	Ventilation design report	2,29 of 46	Ventilation system design verification	CFD analysis	The analysis for the current design is observed to be matched with the validation. However, the CFD shall provide results according to the design inputs and hence the above recommended variations also shall be checked for further reduction of the ventilation requirements.	This shall be considered in the detailed design stage by concessionaire	Any change in the ventilation design scheme shall have significant bearing on the ventilation as well as power cost components in the overall project cost which is highly important in the bidding stage.

84	Ventilation design report	1.10.1, 24 of 46	Fire in ramp: strategy	If there is a fire inside entry or exit ramps near the main tunnel section (up to 100 m from the main tunnel section) the hot smoke will be blown through the closest main tunnel section by means of the jet fans. The entry to the corresponding ramp and the main tunnel tube will be stopped. The vehicles upstream to the fire inside ramps must be evacuated through the entry or exit locations. The passengers downstream to the fire location are required to walk towards the nearest cross-passage in the main tunnel.	The ramps are inclined in the exit direction and declined in the entry direction. If there is a fire in a ramp, the smoke generally moves towards the entry/exit point of the ramp. The immediate strategy should be to close the oncoming traffic and evacuate those in the ramp. This concept has been adopted and is correct. There also needs to be temporary traffic diversion strategy at the entry/exit points to facilitate evacuation and entry of emergency response services. The need for blowing the hot smoke through the closest main tunnel section is not clear as this could affect not only the tunnel/ramp users downstream of the fire, but those proceeding inside the tunnel also. This could also create a panic situation inside the tunnel as people	1) Whether entry or exit, the atmospheric condition may blow the smoke in the tunnel. It has to be forced out towards the open atmosphere and not towards the tunnel. 2) The entry to the corresponding ramp and the main tunnel tube will be stopped. The vehicles moving away from the fire must be allowed to continue moving. The vehicles moving towards the fire, may be abandoned and the passengers shall be evacuated on foot. However a detailed SOP shall be developed by the Concessionaire along with the final design.	Ventilation scheme and evacuation concept during fire are not satisfactory

					are not trained to deal with fire/smoke while driving through a tunnel. This could lead to catastrophic events. The vehicles downstream to the fire location can proceed into the main tunnel and further drive towards their destination. There is no need for them to walk towards the nearest cross-passage.		

85	Ventilation design report	1.10.2, 25 of 46	Cross passage access control	The cross-passages will be used as emergency exit which connect main tunnel tubes. These are located at every 500 m connecting the road tunnel with the other side tunnel. In case of a fire the people can leave the hazard zone via this evacuation route. In order to keep this emergency and rescue path free from smoke, a shear wall with an emergency door is proposed, if possible, for each cross passage. These emergency doors or the main doors have to be equipped with an assisted electrical or mechanical opening system to ensure moderate opening forces of the emergency doors. In	Providing access door to cross passages with centralized access control is a necessary and appreciable step as this helps in pressurization of the cross passages and prevents unwarranted opening of the doors.Doors to be Fire rated for a minimum of 90 minutes.	1. Noted please.	Ok. Query is closed

				addition to that these walls are equipped with a pressure difference measurement to control the pressure difference between the road tunnel and the cross-passages.			
86	Ventilation design report	2.3,31 of 46	Ventilation duct above the road	Fully transverse ventilation proposed with separate ducts for exhaust and fresh air supply.	No lighting inside the duct or access at specific intervals for maintenance purposes considered.	Lighting inside the duct has been considered in electrical design. Maintenance access shall be shown by the Concessionaire in the working drawings after detailed design.	It is not clear in the electrical design details and whether costing for the same is considered.
87			Cross passage fans	Not Detailed in Ventilation Design Report	To be interconnected using Duct works with pressure relief dampers for emergency operation & control.	The cross passages are provided with longitudinal ventilation system, therefore there is no interconnectivity with ducts works. For pressurization of cross passages fans have been provided in each passage. Requirement of the pressure relief dampers will be addressed by the Concessionaire at the detailed design stage. However, normally it is not expected to be provided.	Ok. Query is closed

88			Fire detection & automatic fire suppression in buildings	Not Detailed in Ventilation Design Report	To be considered for Primary Substations, Secondary substations, niches	The provision of the ventilation of primary substations, secondary substations and niches has been made in the cost estimates. The details for the ventilation for the secondary substations and niches have been indicated in the DPR. The detailing of ventilation for primary substations shall be done by the Concessionaire at the time of detailed design depending on the area, location and planning for utilization of spaces in the buildings at shaft locations.	Ok. Query is closed
89			Valve monitoring	Not mentioned in Ventilation Design Report	Using SCADA to be considered	The details for SCADA system for valve monitoring have been considered and it is a part of DPR estimate.	Ok. Query is closed
90			Breaching inlets	Not mentioned in Ventilation Design Report	To be considered at entry and exit ramps	As per IRC, this is not listed into the fire fighting system. However, it shall be dealt by the Concessionaire after detailed design.	Not sure whether costing is considered. This item is mandatory as per NFPA

91			Weather station	Not mentioned in Ventilation Design Report	To be considered @ entry of all 5 no's intersections	2 units of Meteorological detection system are considered in costing which are provided at the main entries of the two tunnel tubes which as per our understanding is sufficient.	Ok. Query is closed
92		159,160 of 201	Fire safety of buildings & substations		Fire sealant provisions to be considered	To be considered in the detailed design by the concessionaire.	Not sure whether costing is considered. This item is mandatory as per NFPA
93		159,160 of 201	HVAC of buildings & substations			To be considered in the detailed design by the concessionaire.	Not sure whether costing is considered.
Tunnel power supply & distribution system							

94	Electrical design report	2.3,10 of 403	Length of tunnel	GIVEN AS 46567m excluding ramps in the Electrical Design Report	Could not find any reference to this length. The total length including both packages including twin tubes comes to less than 34km	Kindly refer Table 2.0 of the report which gives a comprehensive break up of the length of tunnels for each Northbound and south bound tunnels. The length includes the total length of both twin tube tunnels, covered entry and exit ramps but excludes open ramps. This totals to 46567m.	Ok. Query is closed
95	Electrical design report	2.3,10 of 403	Tunnel lighting	30W/m considered; 1397kW considered for lighting in Electrical Design Report	30W/m as a standard does not hold as the lighting intensity varies longitudinally in road tunnels; the lighting power considered is likely on the higher side; expected load could be around 900kW for lighting and small power. Lighting drawing is available as per design (Main Tunnel Lighting Layout Dwg.)	30W/m includes the load of Tunnel lighting, cross passage lighting, substations etc. The Tunnel lighting loads based on the relux simulation approximately was computed to 1076kW which does not include cross passages. The balance load of 300kW caters to lighting of cross passages, all technical buildings, ventilation shaft, utility shafts etc. Hence taking this total of 1376 KW, 30W/m was arrived at.	Individual system load details for lighting is not available, hence the same cannot be verified.
96	Electrical design report		Tunnel technical	Not mentioned explicitly in the DPR.	If considered within the misc loads for 46567m, it is factually incorrect.	Covered in point above.	Ok. Noted

			building loads				
97	Electrical design report	2.4.1,12 of 403	Sectioning of load	5 primary substations at 33/11kV and 17 distribution substations at 11/0.4kV	Sectioning of Load along the length of the tunnel is an appreciable concept, as the proposed tunnel is significantly long	Noted.	Ok. Query is closed

98	Electrical design report	2.4.2.1, 16 of 403	Ring arrangement	Each of these substations will be interconnected in a ring arrangement from their respective primary substations to ensure continuity of supply in the event of fault in any section of the feeder (Refer Figure 1)	The referenced figure is an SLD showing incomings from the 33/11kV side and 11kV DGs. No ring connections could be made out. However, the concept that ring connections are needed is appropriate. Ring connections are provided with multiple incomers. If a ring network is proposed, one 11/0.4kV substation should receive power from 2 different 33/11kV substations and not from a single station. If it is receiving power from one single station, the substation at the higher voltage should have multiple incomers. It is also not clear whether ring connections shall be made at both 33kV level and 11kV level.	Kindly refer to the said figure-1 with SLDs for better clarity. From the 11kV busbar, ring feeder arrangement are shown interconnecting the secondary substations from their respective primary substations which are numbered as S/Sn-1, 9 etc.	In the given figure, the incomer for both the substations (SS 1 and SS 9 are fed by the same incomer. For a proper ring main connection, two separate incomers are required. The earlier query has not been addressed.

99	Electrical design report	2.3,10 of 403	Ventilation load	810 fans with 30kW per fan considered in Electrical Design Report 750 fans (508 Transverse & 242 Longitudinal) proposed in Ventilation Report	The loads shown in the ventilation calculations and the electrical drawings mismatch. In ventilation design, the loads are taken as 22kW and 12kW, then when electrical load is shown it becomes 30kW.	Kindly refer to Section 1.12, Table 21.0 of Ventilation Design Report of DPR. The power load assessment 30 KW per fan is worked out considering 30% increase in power load for emergency scenario.	Earlier observation is not addressed. It is not clear how the rated power requirement could increase during emergency scenario.

100	Electrical schematic drawing		Diesel generator	21 nos. of 11kV 2000kVA diesel generators are proposed	It is a standard practice to maintain diesel generator for emergency backup. But considering 42MVA diesel generator backup requires high capital investment. For the actual tunnel operations, the real time load demand would be less and installing this huge capacity of DG may not be required. With a ring main connection, the requirement for diesel generator would also be minimal. Also, since the tunnel has been classified into different sections for E&M systems, it is not clear why an LV rated DG scheme has not been considered.	LV rated DG is not possible to consider because it cannot be placed within underground tunnels as it will be difficult to take the exhaust pipes out of the tunnel and would also require DG ventilation requirements which will be extra. At this juncture the system cannot be based on real time load demand since the entire load has to be presently catered based on emergency conditions. The ring main arrangement is covering a section of the tunnel approximately 3.0/4.0 kms + additional ramps etc and incase the eventuality occurs at this section the 11KV DG's for that particular section will start. Please note that the 11KV ring arrangement is not overlapping into other tunnel sections. Each tunnel section is independent. Therefore each tunnel section will have to be backed up by its own 11KV DG set.	The requirement for large capacity of DG is connected to the assumed load requirement for ventilation. If the ventilation load varies, the DG requirement would also change. This is connected to the our reply for Sl. No.1 in Tunnel Ventilation section.

101	Electrical design report	2.4.4,27 of 403	Diesel generator	The HSD Bulk fuel storage tank per primary substation will need to be planned. An approval from the Department of Explosives shall be required to install the tanks. For Exhaust stack, as per the notification by CPCB, DG sets with rating 1000 kVA and above will be installed to stand at 30m above the ground.	Storing DG & fuel in underground structure + Provision of 30mtr vent stack from top level of shaft for fume exhaust can be further optimized by placing the generators on above ground level subject to land availability Fuel pumping mechanism to be considered for DG's	The DG set location has been proposed at ground level and not underground kindly refer section 2.5 of electrical design report.	Ok. Query is closed
102	Electrical design report	2.3,10 of 403	Firefighting load	A load of 2430kW has been considered	The details of load such as the capacities of hydrant pumps, jockey pumps and mist pumps are not to be found. It would not be accurate to determine whether the assumed load is less or more without the details.	As per Ventilation report, for water mist system and fire fighting 10% of the total ventilation load was asked to be considered.	Our query is not addressed

103	Electrical design report		Load of associated facilities	Multi-modal transit hubs and other facilities are proposed near the tunnel ventilation station locations	It is not clear whether the electrical loads for the other proposed structures such as multi-modal transit hubs shall be powered from the same electrical supply systems or separate supply shall be received for the same.	Power supply of multimodal transits hubs and related structures for property development shall have separate power supply, which will depend on the developments to be done by the Concessionaire.	Ok. The cost for the electrical load for transit hubs are to be considered in the project estimate.
104			Alternate supply		It needs to be explored whether solar energy could be utilized to operate the tunnel loads over the long term so that there is lesser ecological footprint and there is less dependence on the state grid.	BBMP may take up a separate study for feasibility of solar power or any other multipurpose use of available space. It is not considered in the DPR	Ok. Query is closed
105	Electrical design report	2.4.3,19 of 403	Panel enclosure	The inlet of the cables into the distributors generally shall be made from bottom up (raised floor) with a degree of protection of IP 54 in EM Niches and IP 43 in the Service Buildings / control room.	All enclosures inside the tunnel are recommended to have minimum IP65 rating. All outdoor enclosures outside the tunnel are recommended IP54 or better, and those indoors (buildings) are recommended IP42 or better.	IP 65 are generally considered if the panels are exposed. All the panels/DB's inside the tunnel are either enclosed within a room or inside the niches which are not exposed to water ingress. The proposed system is cost effective	Niches are additionally excavated structures within tunnels and generally, any equipment placed inside the niches are likely to collect dust and moisture. That is why IP65 is recommended as minimum for enclosures inside tunnels. Hence our concern stands unaddressed.

106	Electrical design report	2.4.2.3 & 2.4.3,19 of 403	Cables	(1) XLPE insulated, Aluminium conductor, flat armored with flame proof insulation proposed for HT cables (2) All LT outgoings will be Cu. Conductor, FRLS, armored, PVC insulated, XLPE cables (3) Cabling for jet fans, tunnel lighting and safety equipment will be Fire resistant cables capable of withstanding 950 deg C for 3 hours (CWZ specification). (4) All other cables entering the open space of the tunnel will be Low Smoke Zero Halogen (LSZH) withstanding 250 deg C for 3 hours. (5) Cables, which are laid outside the tunnel, are of FRLS Cross Linked	Point 2 is deemed contradictory to points 3,4 and 5. It is better to maintain the clarity so that confusions do not arise in the technical specifications. It is correct to select fire resistant/fire survival cables for critical circuits. This should be in line with IS 17505. HT aluminium cable with XLPE, FRLS insulation is also correct. However, for non-emergency circuits, LT aluminium cables could be considered subject to local regulations. If this amounts to a substantial quantity, the associated change in cost could also be significant.	Point no 2 pertains to feeders which are catering to panels inside the technical rooms. However we will change these to Aluminium cables in the electrical design report.	Ok. Query is closed

				Polyethylene (FRLS-XLPE)			
107	Electrical design report	2.4.3,21 of 403	Ht & lt cable routings	In the Main Tunnel the LT Power, Control and ELV (Extra Low voltage) cables shall be laid on cable trays mounted on both sides of the tunnel wall.The 33KV and 11 KV HT cables on the other hand will be carried in the utility tunnel under the road. From the utility tunnel cable trenches/ducts to carry 11KV cables would be laid up to the secondary substations located at cross passage and niches. 33KV and 11KV cables to the ventilation station from the utility tunnel or vice versa shall be routed vide a vertical shaft running along	Can be laid through ventilation shaft thereby avoiding utility ducts and cases of seepage	The 11 KV cables from 33/11KV primary substation will be routed from the ventilation shaft and will carried vide the utility ducts to the 11KV substations located in dedicated cross passages which are approximately 2.0km on either side from the ventilation station at grade level. Therefore laying of cables via the utility ducts cannot be entirely avoided. Kindly refer to Figure 4.0 of the report for better understanding. Similar arrangement can be witnessed in ongoing existing project eg. Thane- Borivali.	Ok. Query is closed

				the tunnel wall and then carried up to the utility tunnel through cable ducts/trenches. Cable pull pits shall be provided at regular intervals in the utility tunnel.			
108	Electrical design report		Load for cross passage axial fans	Not mentioned explicitly in the DPR.	If that is also taken as 30kW, considering the number of cross passages, this could either be lower or higher than the actual requirement	We have based the electrical load requirement for ventilation system based on Table 21 of Ventilation report.	The said table only provides the number of fans and some specifications. It does not explain how the load of cross passage fans is arrived at.
109	Electrical schematic drawing		Variable frequency drive	As per the Electrical Schematics, VFD is shown for every fan	Use of VFD is an appreciable concept to control ventilation fans. However, it is not clear why VFD was preferred over soft starter, or whether multiple fans are proposed to be controlled by a single VFD, as VFD has such functionality.	We generally consider VFD's for jet fans with variable speeds.	The selection of equipment should be to meet the intended use. Kindly justify the need for variable speed control. Hence our query is not addressed as yet.

110	Dwg file north package	137 of 201	Fire mains in cross passage	Fire mains has been shown as laid under walkway in cross passage,	Are the pipes in each tube interconnected through cross passage? Are fire hydrants proposed inside cross passages? If the fire main is shown under the walkways, they will require to cross the pavement at the entry of the cross passage. How is this achieved without depressurization issues?	It can only be addressed by the Concessionaire at the time of detailed design resolving conflicts and interface issues.	This inadequacy will reflect upon the technical schedules and related costs.
111	Electrical design report	Table 13,33 of 403	Ups capacity	Electrical Design Report : UPS Sizing	Some UPS units have been sized less than the shown requirement whereas others are rated higher.	UPS sizing cannot be standardized as the lighting load has been calculated based on the tunnel lengths falling under the specific section of primary substation. There are sections which apart of the tunnel length include ramps, hence the UPS capacity was invariance at certain places. For simplicity we have considered UPS at each substation which is why the UPS capacity at some places are higher and lower based on the length of the tunnels it was serving.	The original query stands unaddressed.

Traffic management							
112			Traffic management devices	Boom barrier + Vehicle classification Vehicle overheating system / + height detection system/ rigid gantry+ Number plate recognition Enforcement system	Not shown in DPR		Unattended query
113			Traffic management devices	Variable message signs - External	Not shown in DPR		Unattended query
114			Traffic management devices	Variable message signs, Variable speed limit sings, lane control signs, all kinds of Illuminated signages, road studs, flashers/blinkers - internal	Not shown in DPR		Unattended query
Service areas							
115			SCADA system	Security level of data is to be considered, Data storage facility			Unattended query

				with duration to be considered			
116			SCADA system	Priority of Operation / Control of traffic management system is to be mentioned.			Unattended query
117	Main report	8.9.2,234 of 325	Control building	All the shaft locations shall be developed as a 5 level intermodal Hubs which will house level for services such as SCADA and others control systems required during operation and maintenance of the project. The lowest level will have plate form for deboarding and onboarding on Electrical buses, 3rd level shall cater to car parking and upper two levels have the commercial spaces. The building shall be completed with the	1. Fire Pump room should have facility to prevent room from flooding 2.Fresh air handling unit to be incorporated in surface level / above ground for complete 5 level ventilation. 3.Access control system for Control rooms to be considered 4.Fire alarm , Fire fighting and Fire suppression to be considered 5.Breeching inlet provision for fire water tank - Fire brigade 6. Fire sealant provision / wall fire rating	The said points are well accepted. The Intermodal hubs are planned to facilitate the operation of tunnel and its allied services. At DPR Stage only conceptual layout is prepared the area is earmarked for the intermodal hubs. The design and detailing of the components to be done by the Concessionaire at the execution stage.	It is not clear whether the costing for these items have been considered

				construction in all respects including firefighting, lighting, air conditioning and also design the control services (ventilation, firefighting etc.) for the operation and maintenance of Tunnel Highway including the development of lobby level space for internal & external vehicular movement, land scaping complete in all respects			
118			All service floors excluding level 4		Complete E&M system such as Lighting, Emergency lighting, Earthing system, Air conditioning, Low current system, BMS system, Plumbing works, signages Fire fighting dry & wet riser system, Ventilation, etc, fire sealant provisions		

119			Car park @ level 3		1.Access route to Level 3 from Ground level is not shown? 2. Strategy of car park extract system not shown		
120	Northern /southern package drawings	190-194 of 201	Service floors		Provision of Gents and Ladies toilets in all levels apart from Ground level		
121	Northern /southern package drawings	190-194 of 202	Service floors		Infrastructure works related to water supply and drainage for the entire building		

6.3 ANNEXURE 3 – Details of meetings and site visits.

- **Kickoff meeting**
    - Start off meeting was held on 10th April 2025 involving all committee members, BBMP Officials & Presentation on DPR by Consultant to broadly understand the project.
- **2nd Meeting**
    - The second meeting took place on 17th April 2025, involving Committee members, BBMP officials, and consultant experts to discuss the preliminary observations of the committee. The meeting was led by the Chairman.

- **Site Visit**
    - Site visit was carried out on 19th April 2025 by committee members along with BBMP officials & DPR consultants for making assessment of alignment, availability of land, site constraints, traffic issues at entry exit ramps, Shaft locations and various other aspects such as storm water drainage, structures, trees and utilities likely to be affected, etc.


ST. JOHN'S MEDICAL COLLEGE
Latitude: 12.928704
Longitude: 77.618067
Elevation: 922.11±5 m
Accuracy: 14.1 m
Time: 19-04-2025 12:10
Note: TC inspection
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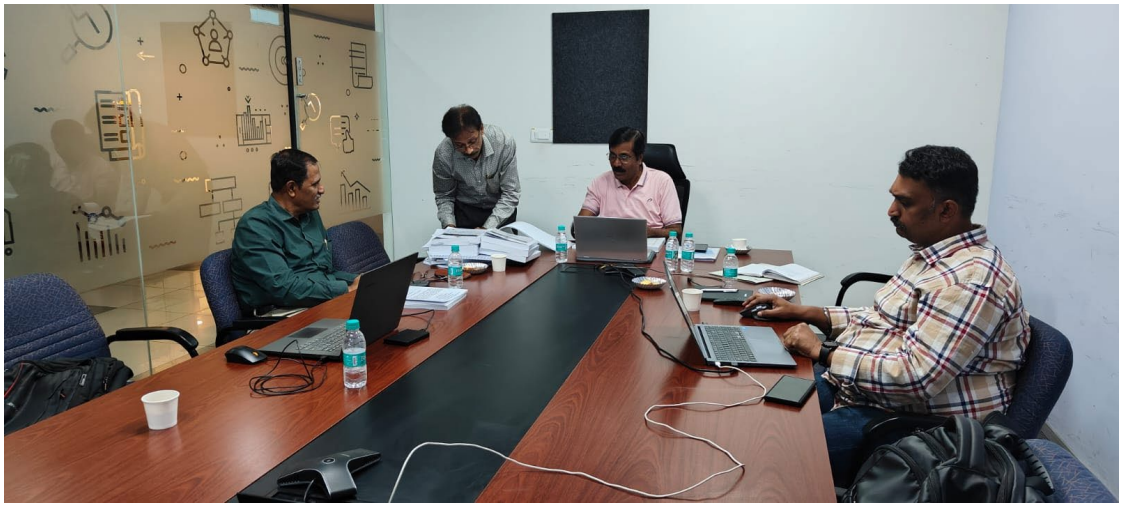
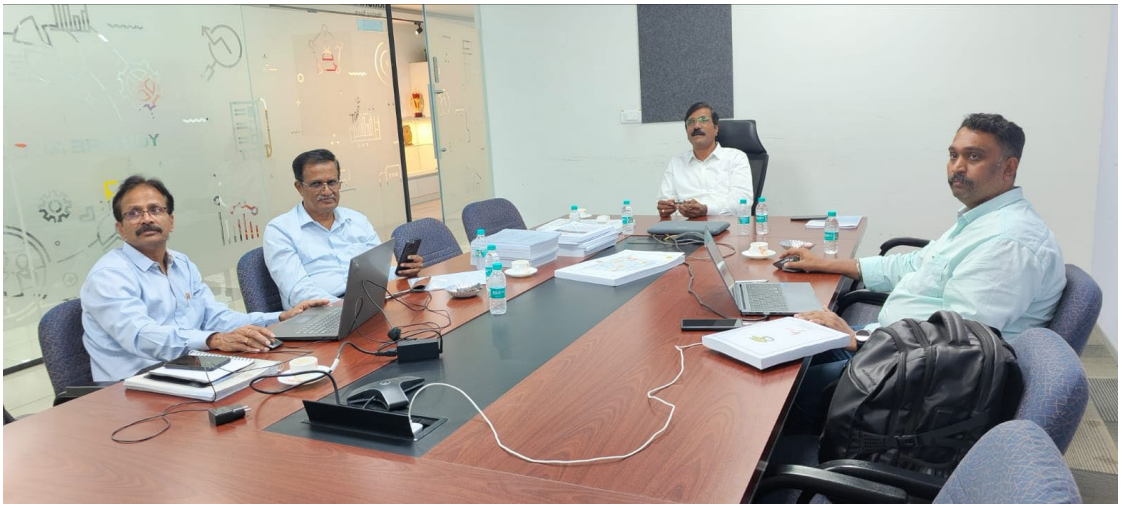
- **3rd Meeting**
    - The third meeting was held between the committee members at BMRCL Office on 23rd April 2025 to review the progress and discuss about the observation points.
- **Subsequent Meetings**
    - The subsequent meetings were conducted on 2nd, 3rd, 4th, and 5th May 2025 for finalising the observation points and preparation of the report.





The committee has availed the services of the following experts in concerned fields while reviewing the DPR documents.

Sl.	Name	Expertise
1	Prof. A Veeraraghavan	Retd. Professor, IIT -M, Traffic Expert
2	Mr. Ajit Ancheri	Senior Tunnel Expert
3	Mr. Rijesh Ramadas	Tunnel Expert & Project Coordinator
4	Mr. Midhun CK	Senior Structural Design Engineer
5	Ms. Swathy Pushpan	Geotech Expert
6	Mr. Nikhil Gopinathann	Senior Electrical Engineer
7	Mr. Hareesh R	Mechanical Engineer (Fire Fighting & Ventilation)
8	Mr. Soumya N	Communication Engineer (SCADA, Communication & Lighting)

6.4 ANNEXURE 4 - Detailed chapter wise observations by the committee

VOLUME 1 - MAIN REPORT

CHAPTER 1 - EXECUTIVE SUMMARY

- It covers the general details of the project. Chapter wise observations are marked below.
- Clause 1.5.1- The role and responsibility of BDA and BBMP needs to be included in this clause.
- Clause 1.5.11. This clause describes education and research facilities in Bengaluru. The details provided about Bangalore University need to be updated with the latest information.

CHAPTER 2 - SCOPE OF WORK

- The scope of work is found in order, however same needs to be covered in detail while finalizing the Draft Concession Agreement (Schedule B).

CHAPTER 3 - SOCIAL AND ECONOMIC PROFILE

- Clause 3.3.10 The details provided about Bangalore University need to be updated with the latest information

CHAPTER 4 - AVAILABLE DATA PLANS

- No comments

CHAPTER 5 - ALIGNMENT STUDY

- Alignment covers densely populated areas of the city and helps bypassing 2 major bottlenecks (Hebbal Junction and Silk Board Junction) and 3 key nodal points (Mekhri Circle, Race Course and Lal Bagh. However, it is noted that the alignment is running almost parallel to the proposed metro line and one of the shafts has been located within Lal Bagh Botanical Garden which is an environmentally sensitive area.
- The entry/ exit ramps are provided at appropriate locations, considering the constraints of availability of land. However, it is noted that the introduction of Entry/ Exit ramps may cause traffic congestion due to the merging of traffic emerging from tunnel into surface traffic. It is also noted that almost all the entry/ exit ramps are in the vicinity of existing signal-controlled junctions. However, the existing signal-controlled junctions may require an improvement which may be addressed suitably.

- Intermediate lane configuration is proposed for entry & exit ramps at Palace Ground/Mekri Circle. As per IRC SP 87: 2019, minimum 2 lane configuration is recommended for entry/exit ramps. Provision of intermediate lanes in ramps would hinder smooth movement of traffic causing delays and risks to the tunnel users.
- The drainage arrangement proposed is without any design calculations and proper scheme. There are crests and sags in the vertical alignment which affects the drainage flow. A detailed calculation is required to understand the adequacy of the proposed drainage scheme. Hence, the drainage scheme couldn't be reviewed. Detailed calculation to understand the adequacy of the proposed drainage arrangements is required.
- It is noted in the drawing that the existing nallah at the downstream of Hebbal Tank Weir (Ch: 450) is proposed to be diverted through U-turn with long detour towards Airport which is unrealistic. Detailed hydraulic calculations and designs for the proposed diversion of nallah are not available. The proposed diversion of nallah at the downstream of Hebbal Tank Weir (Ch: 450) is to be dealt with utmost care and avoid such long detour. It is suggested to carry out the detailed hydraulic calculations considering 100 years return period / SPF.

CHAPTER 6 - ENGINEERING SURVEYS AND INVESTIGATION

- The survey report comprising Coordinate systems, Control points, Bench Marks, etc. is not included in the report, the marking of buildings, trees, utilities, railway lines, metros etc are to be captured in the report.
- The geological, geotechnical and geophysical studies are being conducted for the project which is more or less in line with IRC SP 91: 2019 guidelines that recommend following Bore hole configuration.

  (a) Portal Locations - 02 Deep NX size Boreholes; One vertical one inclined/ Horizontal.
  b) ¼ Length - 01
  c) ½ Length - 01 Generally, around max overburden area
  d) 3/4 Length - 01
  e) Shaft and Adit locations - Site based (preferably at portals and intersection areas)

- The submitted GIR is mainly based on geophysical studies and geotechnical investigation of 4 boreholes. As per the Pre final Geotechnical Interpretive Report (Table 6: page no: 32 of 39) 27 boreholes are proposed for the project. The remaining investigations are in progress as indicated in the report. The GIR needs to be updated after completing all geotechnical investigations including updating the Geological L-Section.
- Reports by CGWB and BIOME Environmental Trust indicate the presence of aquifers at shallow depths varying around 35m in Bengaluru Urban area. However, ERT studies which provide information on the presence of underground water are not conducted. It is strongly advised to perform ERT studies to avoid unexpected hazards during tunnel boring.

CHAPTER 7 - TRAFFIC STUDY AND ANALYSIS

- As per IRC SP 87: 2019, the number of lanes in a traffic tunnel shall be based on the traffic projections for 25 years. As per traffic data, 2041 demands only 2+2 lanes with paved shoulders, however the proposed 3+3 lane configuration is satisfying the projected traffic requirement for 25 years of horizon period. In view of this, either horizon year needs correction or lane configuration needs modification.
- Year wise traffic projections along the proposed corridor duly considering the competing modes of transport under completion and the year in which the proposed tunnel Road would reach its capacity couldn't be found in DPR.
- While the key assumptions made for travel demand forecasting appear to be based on CMP 2020, the same is to be validated based on the Traffic survey & demand assessment and justify the values adopted from the CMP for the present project as per the scope of work stipulated in para 2.1 (a) in page-73.
- Detail calculation of Peak hour & Daily projected traffic volume (Cars, Taxis & Buses) expected to be diverted to Tunnel Road is to be submitted for justifying the lane configuration.

CHAPTER 8 - IMPROVEMENT PROPOSALS

- Intermediate lane configuration is proposed for entry & exit ramps at Palace Ground/ Mekhri Circle. Provision of intermediate lanes in ramps would hinder smooth movement of traffic causing delays and risks to the tunnel users.

CHAPTER 9 - PROJECT IMPLEMENTATION AND SCHEDULING

- The detailed construction schedule showing all activities of work in line with the proposed construction period is not available. The same should form part of the DPR duly incorporating the timelines for Land Acquisition, utility relocation, procurement of TBM considering the large diameter and complex geology of Bengaluru etc.
- The detailed method statement for critical activities like shaft excavation, breaking and widening for additional lanes at entry/exit areas, underground tunnel excavations, breaking for construction of cross passages are not available in the DPR. The same should be included.

CHAPTER 10 - PRELIMINARY COST ESTIMATION

- The cost of TBM considered is based on an enquiry from only one vendor i.e., M/s. Herrenknecht AG which is not as per the laid down norms in KPWD.
- Wherever market rates/ non-SoR items are considered in the absence of Schedule of rates, three quotations from three different vendors are to be taken and follow the standard procedures.
- The Lumpsum provision is made in the cost estimate for Land Acquisition, utility shifting, instrumentation, BCS, Electric buses, toll collection system etc. The detailed estimate to be provided.
- Cost towards transportation and dumping of TBM muck (25,78,932 cum), secondary grouting, establishment of the casting yard, cutter head intervention, cutter discs consumptions, closing of open well/ Borewell are not considered in cost estimate. This may have a significant impact on the total project cost.
- The cost towards “Cost of extra TBM taken by TBM” (Item No. O of Rate Analysis for tunnel boring (Page 142) for Rs. 306.00 Crore is not clear which needs clarification.
- The cost of Operation & Maintenance for 25 years is not included and shall be a part of the cost estimation.
- The rate analysis for several items does not match the rates given in the BoQ and analysis of unit rate For e.g., rate analysis shows the rate of Swellex bolt of 25mm dia as Rs. 4026.90 for 4 m length but in analysis of unit rate (page 140/148 of 2. Cost Estimate - Northern Package 1) the rate is Rs. 312.50 per m. This discrepancy is in

other items also. Another example is the rock bolt rate for SN type. In Cost estimate, SN bolts of 25mm dia have a rate of Rs. 4034 per meter length (Sr No 33 of Main Tunnel Cost Estimate, Page 14/148 and Sr No. 120, Entry/Exits Cost estimate, Page 20/148) whereas in Entry/Exits Cost Estimate, Sr No. 13, Page 17/148 shows the rate as per piece of 4m. In Rate Analysis, the rate of Rs. 4034 is shown per piece of 4m. As it could be a typo error, the quantity shall be cross checked to ensure correctness.

- In the report of Cost Estimate: Cost Preamble: Clause 1.2.6, it is mentioned that a transportation lead of 45 km is assumed for muck disposal and concrete/precast concrete items. It is felt that 45 km can be taken for muck disposal but not for concrete/ precast concrete.
- The detailed cost estimation is required for Land Acquisition, utility shifting, instrumentation, Building Condition Survey, Electric buses, toll collection system etc. as these components involve major cost implications.
- Cost towards transportation and dumping of TBM muck is not considered (25,78,932 cum)
- The cost considered for segmental lining in TBM tunnel is Rs. 13,19,931/- Item. 16 of cost estimate (Page 13) works out to be Rs. 27,215/- per cum which appears to be less.
- The cost of secondary grouting in TBM tunnel is not considered.
- The cost for establishment of the casting yard is not considered.
- The cost considered for maintenance of TBM supporting equipment is Rs. 129.41 crore only which is 10.88% of Rs. 1189.89 Crore (Rs. 1042.72 Cr + 147.16 Cr), Page 142, appears to be less.
- The cost of consumables (waterproofing gasket, etc.) required in TBM tunnel are not considered.
- The cost of cutter head intervention and consumption of cutter discs in TBM tunnel is not considered.
- The cost pertaining to Launching arrangements of TBM are not considered.

- The cost towards “Cost of extra TBM taken by TBM” (Item No. O of Rate Analysis for tunnel boring (Page 142) for Rs. 306.00 Crore is not clear.
- Cost towards closing of open well/ Borewell is not considered
- The cost of Cross Passages considered is on the lower side.

CHAPTER 11 - FINANCIAL ANALYSIS

- Not reviewed.

CHAPTER 12 - ECONOMIC ANALYSIS

- Not reviewed

CHAPTER 13 - OPERATION AND MAINTENANCE

- The O&M period considered is 25 years. Most of the Electrotechnical equipment and system has a maximum life span of 20 years. The methodology including cost for replacement of such equipment needs to be brought out in the DPR.

CHAPTER 14 – CODES AND REFERENCES

- Even though the proposed tunnel is 3+3 lane configuration, IRC SP 87: 2019, Manual of Specifications and Standards for Six Laning of Highways (Second Revision) is not listed under reference which is relevant for this project. This needs to be added to the list.
- The data collected from metro projects in Bengaluru used in geological reports as references are not mentioned in the list.

VOLUME - II A - GEOTECH DESIGN REPORT

- Observations are recorded in this report under Chapter 6 of Volume 1, Main report.

VOLUME - II B - STRUCTURAL DESIGN REPORT

- The segment clear cover should be a minimum of 50mm for extrados instead of 45mm mentioned in the design report.
- The temporary support proposed for deep excavations is only in the form of secant/ soldier piles with anchors. The provision for providing temporary struts also may be prescribed as anchors are not sufficient in soil strata.
- NATM construction sequence in detail including ground stabilization needs to be provided.

- Drawings showing details of launching/ retrieval shafts need to be provided.
- It seems flotation check for all underground structures could not be found which is required for underground structure designs.
- The report on instrumentation and monitoring could not be found. The same needs to be furnished in the report.
- Creep and temperature load is not considered in the design of NATM and Cut & Cover sections. The design may be updated duly considering creep and temperature loads.

VOLUME - II - C - ELECTRICAL DESIGN REPORT

- 9 Electrical substations have been proposed in TBM tunnel portion. It is noted that one substation requires 2 cross passages at a distance of 11.785 m (c/c) construction of cross passages at such close proximity is practically not feasible. The possibility of locating the electrical substations outside the TBM tunnels may be explored
- The parameters considered in the lighting report do not match the design reports. For eg., the design speed in lighting simulations is shown as 100 kmph whereas the design speed as per reply by consultant is 80 kmph. The calculation for intensity of sunlight at portal is not provided in the report. The higher value will lead to a larger number of lights. More lights mean more power requirement

VOLUME - II - D - VENTILATION DESIGN REPORT

- The transverse ventilation scheme proposed is without the cost comparison studies with alternate systems. The ventilation systems will have a major impact on the project cost due to power consumption and maintenance requirements. As per IRC SP 91:2019, longitudinal ventilation system is economical for tunnel length up to 4km and the proposed tunnel is having openings at less than 4 km interval. The possibility of adopting longitudinal ventilation system may be explored.
- On studying various cross sections like TBM tunnel, cross passages, ramps, shafts, buildings, it is noted that the fire main and hydrants are shown on RHS in TBM tunnel and on LHS in ramps. It is not clear how continuity is ensured. The design calculations for pumps capacities, sprinkler system, mist system etc. are not provided. The mismatch in the fire main and hydrant location shown in various cross sections needs to be corrected.

- The design calculations for pumps capacities, sprinkler system, mist system etc. are to be included in the design report

VOLUME - III – PRE-FINAL GEOTECHNICAL INTERPRETIVE REPORT

- The Geotechnical Interpretive Report provided is prefinal as the geotechnical investigation is still under progress. The final Geotechnical Interpretive Report after completing the ongoing geotechnical investigation and ERT studies needs to be submitted.