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Public Works Department

(Government of Manipur)

Consultancy Services for Feasibility Study and Preparation of Detailed Project Report for Proposed Construction of Imphal Ring Road in the state of Manipur



IMPHAL RING ROAD

FINAL DETAILED PROJECT REPORT VOLUME I : MAIN REPORT



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September, 2022

Executive Summary

EXECUTIVE SUMMARY

0.1 PROJECT BACKGROUND

The Manipur Public Work Department as implementing agency intends to apply a portion of the financial assistance for providing Consultancy Services for the feasibility study report and preparation of detailed project report.

Table 0.1: Project Roads

S. No.	Name of the Road	Length (as per TOR)	Total Length
1.	Imphal Ring Road	36 km	127 Km
2.	Imphal Kangchup Tamenglong Tousem Haflong Road	91 km	

0.2 CONSULTANCY SERVICES

In pursuance of the above, Intercontinental Consultants and Technocrats Pvt. Ltd (ICT), India was appointed as Consultants to provide Consultancy Services for Feasibility Study and Preparation of Detailed Project Report for Imphal Ring Road and Imphal Kangchup Tamenglong Tousem Haflong Road in the state of Manipur. The consultancy agreement for the services was signed on 24th January 2014 and the PD, SASEC, PWD Manipur asked the consultant to commence the consultancy services not later than 4th February 2014 vide its letter 14/PD/NESRIP/SASEC/2013/220 dated 24th January 2014. The consultant vide letter no. ICT: MANIPUR: 702:981 dated 27th January 2014 agreed to commence services from 4th February 2014 in accordance with the Conditions of the Contract.

The scope of principal objectives of the consultancy services to be provided is contained in the Terms of Reference (TOR) prepared by SASEC, PWD Manipur, which is part of the contract agreement.

The Consultants submitted the Inception Report vide letter no. ICT:MANIPUR:702:2364 dated 1st March 2014. The Draft Feasibility Report was submitted vide letter no. ICT:MANIPUR:702:4266 dated 16th April 2014 and the Final Feasibility Report was submitted vide letter no. ICT:MANIPUR:702:9052 dated 2nd September 2014. Draft Detailed Project Report was submitted vide letter no. ICT: MANIPUR: 702:11138, dated 11th November, 2014 and Final Detailed Project Report was submitted on 27th March 2015.

Further PWD, Manipur desired revision in the alignment of Imphal ring road, to ensure connectivity to some additional vital installations of city and further ensure benefits and quick access to such installations to larger population.

Accordingly, a supplementary agreement was signed on 18th January 2020 for updating the DPR of Imphal ring road. As part of the scope Consultant will have to submit updated DPR Report with revised alignment as envisaged by PIU for proposed Ring Road.

Based on the discussion the proposed improvement length of Imphal Ring Road was about 46.785 Km whereas the aggregate length is about 53.180 Km (includes NH 202 & AH 1- 6.395 Km). The length of SPUR to JNIMS is 0.575 km and SPUR to FCI is about 1.08 Km. Based on this length, the Draft DPR was submitted in May 2020.

In compliance to the comments and suggestion from Government of Manipur to minimize the private land acquisition, the alignment further revised and PROW width has been reduced. The alignment from km. 0+300 has been deviated towards Bashiklong village and joins to the old alignment at km. 1.900 and the Final DPR was submitted in July 2021.

During Scrutiny of forest diversion proposal, the concerned forest department demanded for reduction of forest land. Accordingly, the alignment has been slightly revised to reduce the forest land requirement. Further to the discussion with stake holders to reduce the social impact in April 2022, the lane configurations have to be changed for some sections. The same has been revised and final length of Improvement of Imphal Ring Road is as follows:

As per the revised alignment the proposed improvement length of Imphal Ring Road was about 47.765 Km whereas the aggregate length is about 54.155 Km (includes NH 202 & AH 1- 6.39 Km). The length of SPUR to DDK (Spur 1) is 1.57 km, SPUR to RIMS (Spur 2) is about 0.815 Km and SPUR to FCI (Spur 3) is about 1.08 Km

After submission of updated Final DPR for Imphal Ring Road, based on Land acquisition involvement and progress, PWD, Manipur desired to bifurcate the Imphal Ring road in three packages for implementation. The Packaging details are as follows:

PKG	Stretches	Location	Length (in Km)
1	Km 0.00 to Km 14.715	Kiyamgei to Chairenthong	14.715
	Km 14.960 to Km 17.900	Konsam Leikai to Heingangpat	2.94
	Spur to DDK		1.57
Total Length of Package 1			19.225
2	Km 17.900 to Km 25.980	Heingangpat to CMC Hospital	8.08
	Km 32.125 to Km 43.100	Sanhakpham Bazar to Iroisemba	10.975
	Spur to RIMS	--	0.815
Total Length of Package 2			19.87
3	Km 43.1 to Km 54.155	Iroisemba to NH-102 (Near Gambhir Singh Statue)	11.055
	Spur to FCI Godown	--	1.08
Total Length of Package 3			12.135
Grand Total			51.23

As seen from above, the bifurcation of Main ring road has been proposed in 5 stretches. Hence package wise DPR has not been prepared. The cost estimate and bidding documents has been bifurcated in Packages. This Final Detailed Project Report deals with Greater Imphal Ring Road.

0.3 BRIEF SCOPE OF SERVICE

As per the supplementary agreement the Consultant have to submit the following for Imphal ring road:

- a) Draft updated DPR with Bidding Document
- b) Final updated DPR with Bidding Document
- c) Submission of LA Plan and marking of Center line, fixing of ROW pillars.

This report deals with updated Final Detailed Project Report for Imphal Ring Road.

An Index map of the Ring Road comprising of different roadway segments and the obligatory points is shown in **Figure 0.1**.

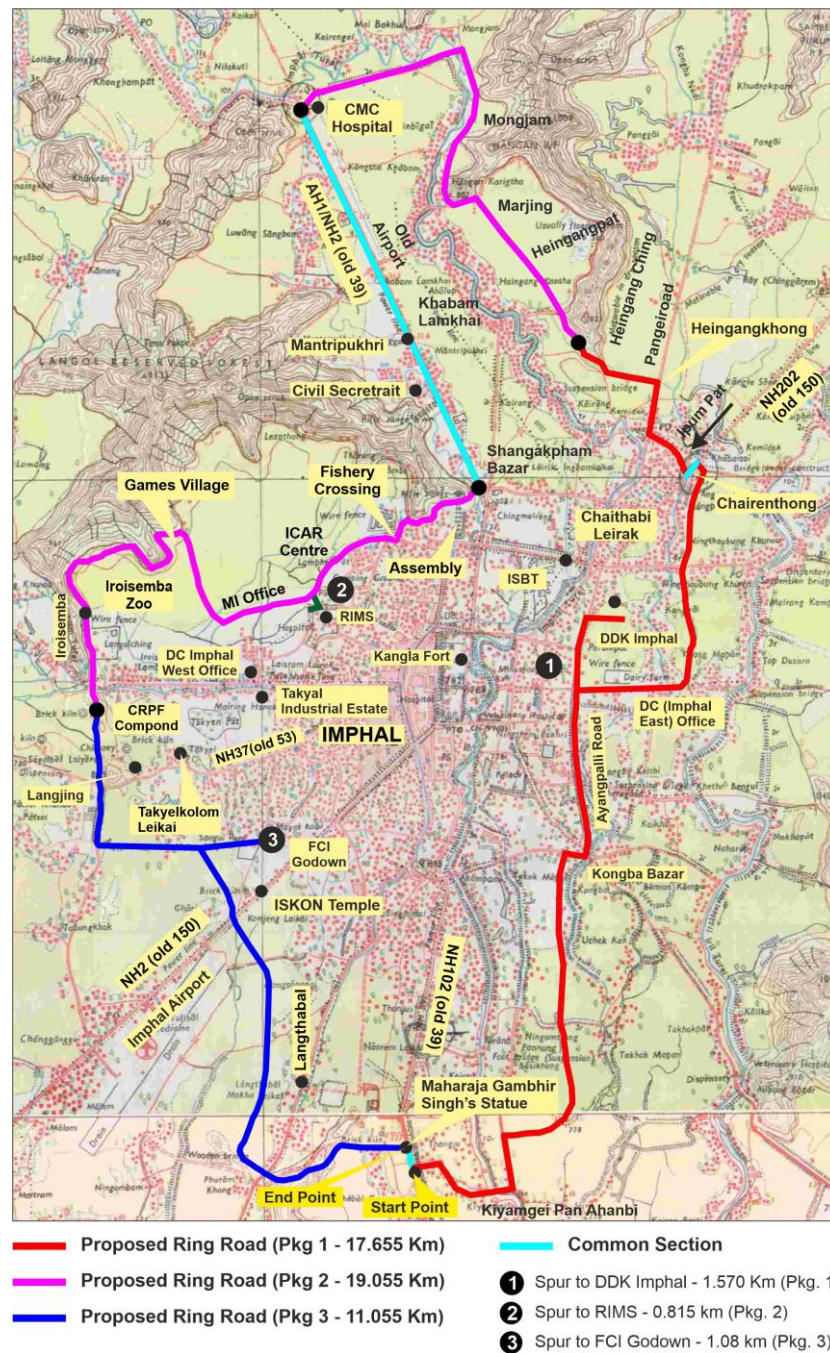


Figure 0.1: Index Map

0.4 PROJECT RATIONALE AND OBJECTIVES OF IMPHAL RING ROAD

Imphal City, the capital and the most populous city of the State Manipur, has seen rapid exponential growth in traffic since the beginning of the millennium particularly in the past 15 (fifteen) years. The growth rate of vehicle registration in the last 5 years averages about 15% annually against the normal traffic growth rate of 7.5% assumed as per IRC, whereas the expansion of the city road has been stagnant or minimal. This has resulted in chaotic traffic in the major routes within the inner core of the city with traffic jams and delays in the major intersections. The Imphal Ring Road project was conceptualized to address the incremental and perpetual traffic congestion of Imphal City and will provide a logical solution for the Urban Transport Management of the City. The project is a city centric project intended at providing better connectivity, promote expansion of city, alternative or improved connectivity to major institutes and enable decongestion of the city. The project shall result in reduced journey time and travel cost, thereby increasing the productivity and overall economy of the State.

A study on the Road Network of the city, conducted by “Egis International” under ADB TA-7650 in 2015, determined that the Level of Service in the six (6) critical traffic junctions, taken up as sample studies, to be “F” (which is the worst rating) and the degree of saturation to be much higher than 1 (demand to capacity ratio). The volumes of traffic during the peak hour in these junctions were higher than that of European Cities. This resulted in high congestion, delayed journey time and overburdened capacity. It was estimated that savings amounting to USD 19.12 million (Rs. 141.49 Crore) would incur from minimization of idling time at the junctions. The study also projected the road network of the city to become non-operational in ten years’ time i.e., by 2025 unless a viable solution to ease the flow of traffic is implemented. The Imphal Ring Road is one of the solutions to resolve the incremental traffic congestion in the Imphal City along with National Highway Projects of Imphal Bypass and Elevated Highway which shall divert the National Highway Traffic from the City. The project also aims to provide a rapid transit & accessibility to the important institutes of the Imphal City which includes administrative offices, health care, academic establishments, and commercial centres.

The traffic congestion and quality of the existing roads has highly restricted the mobility of the inhabitants of the city and minimised the Ease of Living of the City. Introduction of Public transport system in the form of e buses or low floor buses which will promote cleaner environment and reduce cost of travel, improve mobility and ease of living in the city are also not feasible under the present scenario.

Several national highways connecting to other major cities of the country along with trans-Asian routes pass through the Imphal City since Manipur is a border State of the Country and gateway to Southeast Asia through Myanmar. Thus, Imphal also forms a key node in the South Asia Sub-regional Economic Cooperation (SASEC) transport corridors. The passing of the highways within the city is another factor for the congestion as well as traffic management. The Imphal Bypass project and the Elevated Highway project, which are highway centric projects shall cater to the highway traffic comprising of heavy goods truck and other commercial vehicles, are being implemented by concerned authorities. These two projects shall complement the Imphal Ring Road project by diverting heavy vehicles (Trucks) of highway bound traffic away from the city leading to overall ease of traffic congestion, improved connectivity, minimized travel cost and journey time leading to overall improvement of standard of living with higher quality of life. The Imphal Ring Road has been designed to cater to the city

centric traffic which comprise of mainly (i) Private Vehicles (Car, Jeeps, Two Wheelers) and (ii) Commercial Passenger Vehicles (Three Wheelers, Stage Taxis, Vans) which are more than 93% of the total traffic volume and very few heavy multi axle trucks which are less than 1%. The sections comprise of predominantly double lane with paved shoulder of 40.045 Kms which is 84% of the total length and only 7.72 Kms of divided 4-Lane Road (16%). These configurations are justified and substantiated through the Traffic Data of the Imphal Ring Road network which is included as a part of the Detailed Project Report.

Some salient features and the main objectives of the Imphal Ring Road

1. Construction of Quality Urban Road Network through improvement and widening of existing City Roads to increase capacity and improve riding quality and construction of additional green field roads to provide alternative connectivity to major Public Institutes including enabling adoption of Rapid Public Transport System such as low floor e-buses etc to minimize use of private vehicles thus minimising number of private vehicles on road leading to decongestion and minimisation of environmental pollution.
2. Rapid access with minimum interruption to relocated Administrative, Judicial, Health Care, Educational Institutes and Commercial Centres promoting Citizen-Friendly and Easily Accessible City increasing Ease of Living.
3. Promotion of Expansion of the City in Line with the Policy and Vision of the Union Government by assuring connectivity and ease of accessibility to the periphery of the City resulting in reduction of traffic in the City Centre minimizing congestion.
4. Overall improvement on the State's economy through reduction in journey time and travel cost, wastage of fuel and time resulting in reduction of Vehicle Operating Cost (VOC) and Freight Charges. Minimization of stage travel of commuters from origin to destination which will greatly reduce travel cost.
5. Promotion of commercial activities, ease of living and value addition of the city to enable realizing advantage of the development of Trade and Commerce with ASEAN countries through improved transport logistics.
6. Promotion of positive Climate Change through reduction in Carbon Footprint by enabling adoption of capacity and energy efficient transport modes, lessening of idling time, innovative technology during construction.

The outputs of the Imphal Ring Road project are as given below:

1. An Urban Road network of Imphal City with high quality pavement incorporating road safety features, high standard riding quality and proper traffic management through improvement of junctions and channelisation etc of 51.23 Kms(estimated).
2. Introduction of Electric Buses/Low Floor Green Buses to promote economical, affordable, and comfortable Public Transport System encouraging discontinuation use of private cars leading to decongestion and promoting cleaner environment and ease of living.
3. Construction of a model Road Stretch of 1.30 Kms incorporating all amenities (Cycle Track, pedestrian walkways, jogging track etc) of an Urban Road.
4. Decongestion of city traffic and improved accessibility to major Administrative, Judicial, Health Care, Educational Institutes and Commercial Centres.

5. Maximation of human productivity through improvement of time utility, minimization of time loss in traffic and traffic strain on commuters. Employment generation of semi-skilled and skilled workers in the State.
6. Felicitation of growth of commerce, trade, tourism, etc leading to positive impact on overall economy of the State and the country as a whole.

Social and Environment Safeguards: The project shall be implemented in compliance with the Land Acquisition, Rehabilitation and Resettlement Act, 2013, Environmental Laws of the Country and ADB Safeguard Policy Statement, 2009. Necessary due diligence and consultations shall be carried out as per the act.

0.5 ENGINEERING SURVEY AND INVESTIGATIONS

The consultants have carried out engineering surveys and investigations that include Topographic Surveys, Road Inventory and Pavement Condition Surveys, Alignment Studies, Pavement Composition Investigations, Preliminary Material Investigations for Construction Materials, Inventory and Condition Surveys for Bridges, Culverts and other Structures.

Terrain

Project alignment for Imphal Ring Road is mostly in plain & small part in rolling terrain.

Land Use

Land use pattern for the Imphal Ring Road stretch is predominantly built up with both residential and commercial establishment on both sides and some stretches passes through cultivation (Greenfield).

Carriageway / Pavement

Generally, the pavement of the existing sections of Imphal ring road is in good condition and in some sections, it has been recently paved. Isolated potholes due to inadequate drainage are observed. Project alignment cover along existing alignment for approx. 30 km has carriageway width between 3.0 m to 6.5 m. As such for planned improvement proposal with capacity augmentation these are inadequate widths and require widening.

Roadway Geo-metrics

Geometry of Imphal Ring Road for major portion of the stretch does not conform to IRC standards. Horizontal alignment has S Curves, or curves with small radius not conforming to IRC Standards. Due to settlements and substandard geometry, locations with deficient sight distance are observed. The alignment in plain terrain vertical geometry generally conforms to IRC standards but the rolling terrain stretches has sharp bends & non-standard geometry.

Road Intersections

Based on field investigation of Imphal Ring Road along proposed alignment, following number of existing intersections are recorded,

Major Intersections: 36; Minor Intersections: 234

Right of Way

As per PWD records Imphal Ring Road alignment has existing ROW in range of 8m to 35m.

Existing Bridges / Structures

Imphal Ring Road

The Inventory of all bridges having lengths of more than 6m were carried out. These bridges comprise of the followings:-

- **Major bridges** (length \geq 60m) Nil
- **Minor bridges** (length $>$ 6m and $<$ 60m) 4 nos.

At present there are no existing flyovers, ROBs and Underpasses in the project stretch.

Existing Culvert

Imphal Ring Road

The details of the existing culverts are as follows:

Table 0.2: Existing Culvert Details

Imphal Ring Road			Spurs	
Slab	Hume Pipe	Box	Slab	Hume Pipe
41	41	1	6	1

0.6 ALIGNMENT OPTIONS

During Feasibility study, three alignment options was studied for the Ring Road around Imphal city with each option consisting of segments of existing road network in Imphal City and also sections where new green field alignment is proposed to minimize impact on settlements. These options have been formulated taking into account the obligatory points given in Terms of Reference (TOR). After careful consideration & site visits of Group of Ministers, the alignment Option II as given in final feasibility Report for the Imphal Ring Road alignment for a length of 46.635 km (Including NH202 & AH 1- 4.695Km) and three Spur alignments has been approved by client due to its better connectivity vide email dated 19th July 2014 and vide letter no. 14/PD/NESRIP/SASEC/2013/166 dated 01.10.2014. The common portion of NH202 & AH 1 was excluded for improvement.

Further upon several review meetings and presentation post Draft DPR submission, with concerned decision maker's minor modification for alignment were discussed and incorporated now part of Final DPR improvement proposal. The alignment now approved for Final DPR stage vide letter number 52/5/2014/-W(SASEC)pt. dated 7th February 2015, consist of aggregate length of 47.961 Km (includes NH 202 & AH 1- 4.62 Km) and Two spur alignment with aggregate length of 1.655 Km. The common portion of NH202 & AH 1 have to be excluded for improvement.

In latter stage, PWD, Manipur desired revision in the alignment of Imphal ring road, to ensure connectivity to some additional vital installations of city and further ensure benefits and quick access to such installations to larger population.

The start point is shifted 287m near Manipur University away from City to align with new under Construction Bridge. As per revised proposal, the stretch from Kongba Bazar to Khabam Lamkhai has been replaced by an alignment through *Impup Pond Road*, Haingang lake and connects NH2 near CMC hospital. The previous proposed stretch inside Games village has been replaced by the alignment along Fishery office and connects near Shija hospital to the old alignment.

As per the revised alignment the proposed improvement length of Imphal ring road is about 47.765 Km whereas the aggregate length is about 54.155 Km (includes NH 202 & AH 1- 6.39 Km). The length of SPUR to DDK is 1.57 km, SPUR to RIMS is about 0.815 km and SPUR to FCI is about 1.08 Km.

0.7 TRAFFIC STUDIES & ANALYSIS

The proposed Ring Road is partly new alignment and also includes a section of existing road which is to be improved. Thus the traffic volume count surveys were conducted on the existing section of the Ring Road and on the various radial routes which are going to cross by this proposed road such as NH-39, NH-150, NH-53 etc. Couple of traffic surveys also conducted on major roads inside the city area to access the travel pattern of Imphal City. Traffic volume count was conducted at 28 locations including existing sections, outer cordons and inner cordons. It included 27, 12 hours MCC counts and one 7-day count at the outer cordon on NH-39. O-D survey was also conducted at 14 locations on the surrounding network for 12 hours, in order to assess the travel pattern and preparation of base year travel demand model.

The traffic data analysis of the traffic on existing and surrounding network shows that the maximum traffic volume is observed at OC-1 location on NH-39 (AH-1) near Old Airport, in the order of 38,723 PCU (30,075 vehicles). Higher traffic volume of 32,107 PCU on Silchar Road (NH-53) at IC-16 location and 27,141 PCU is observed on Imphal-Myanmar Road (AH-1) near Lilong-Imphal section at OC-6. The lowest AADT volume is found at OC-04 between Lamlong and Tekhel in north-east suburb of Imphal, which is 3,866 PCUs (2,775 Vehicles).

The traffic estimations for various sections of proposed Ring Road have been obtained by using the calibrated and validated transport demand model developed for the study area. The traffic on the proposed Ring Road will mostly comprise of diverted traffic from the existing other roads to the Ring Road, where the improved alignment will avoid several bottlenecks and bad road condition. The Ring Road will attract long distance through traffic from regional roads (NHs and SHs) feeding to the sub-arterial and collector and also local traffic system. The Ring Road will serve (i) the long distance regional traffic (feed through the regional roads), (ii) the urban traffic diverted from local parallel roads, and (iii) the local traffic generated/destined to the areas nearby the Ring Road. Thus, it is going to serve many purposes of travel.

The above Traffic surveys for ring road and connecting road network were conducted in year 2014, and report was submitted in 2014. Further to this traffic projection were revised in year 2020 and the revised report was submitted in year 2020.

The calibrated transport model developed for the base year (2014) was used to forecast the horizon year traffic flow on road network. The horizon year road improvements, as described in Chapter4 of submitted report, and traffic generation, were made use of in the model.

After studying the traffic assignment of Ring Road for future years, Ring Road has been divided into few homogenous sections.

The details of homogeneous section are as follows:

Table 0.3: Homogeneous Sections

Homogenous Sections	Chainage (km)	
	From	To
HS-1	0+000	2+200
HS-2	2+200	7+000
HS-3	7+000	10+815

Homogenous Sections	Chainage (km)	
	From	To
HS-4	10+815	14+715
HS-5 (NH-150)	14+715	14+960
HS-6	14+960	25+980
HS-7 (NH-39)	25+980	32+125
HS-8	32+125	33+575
HS-9	33+575	42+875
HS-10	42+875	44+400
HS-11	44+400	48+335
HS-12	48+335	54+155

The new alignment of the project road is mostly in plain terrain except a small section, and therefore, for improvement proposals for plain terrain with urban area standard (IRC: 106) has been followed.

Since the traffic projection was based on the survey conducted in 2014, PWD Manipur intended to revalidate the projection in 2022. As decided by Manipur PWD, the Consultants have carried out traffic surveys on selected locations in year 2022 to validate the traffic forecast.

The AADT observed in the year 2022 has been compared with projected AADT of corresponding sections in the year 2014 to study the difference in projected and actual traffic. Based on this, a conversion factor (ratio of new observed AADT and projected AADT of current year) has been calculated. This conversion factor has been applied to estimate the revised the traffic of corresponding homogenous section nearby to the surveyed location.

The **Table 0.4** presents, (A) the estimated traffic for year 2022 based on traffic studies conducted in year 2014, (B) observed traffic in year 2022, and (C) factor calculated, i.e. (B)/(A).

**Table 0.4: Comparison of forecast traffic (from 2014 Study)
with observed traffic for Year 2022**

Section Name	Car	Two Wheeler	Three Wheeler (Passenger)	Bus & Mini-Bus	LGV 3 Wheeler	LGV 4 Wheeler	2-Axle Truck	3-Axle Truck	MAV	Total
A-Traffic Volume at selected location along the ring road, estimated for year 2022 (Vehicles/day) – Using 2014 Survey & Revised Growth Factors										
OC 6, NH 102	17065	9502	6378	1371	430	839	601	200	44	36430
Porompat DC Road	7560	3756	7547	568	1625	733	450	382	212	22833
OC 4, Lamlong-Tinsid Road	1644	1543	175	36	18	113	676	7	0	4212
OC 8, NH 2	14317	7422	4768	430	91	503	545	152	9	28237

Section Name	Car	Two Wheeler	Three Wheeler (Passenger)	Bus & Mini-Bus	LGV 3 Wheeler	LGV 4 Wheeler	2-Axle Truck	3-Axle Truck	MAV	Total
B-Traffic Volume at selected location along the ring road, observed in year 2022 (Vehicles/day) – Actual Survey in 2022										
LOC 1, Km 0+000, NH 102	16724	10167	5358	1234	421	822	529	192	40	35487
LOC 2, Km 9+900, Porompat DC Road	6728	3155	6641	239	1950	880	360	88	40	20081
LOC 3, km 13+200, Lamlong-Tinsid Road	1989	1512	147	27	14	96	615	9		4410
LOC 4, km 47+900, NH 2	25771	12246	7152	516	132	905	927	274	14	47937
C=B/A- Factor for estimation of revised traffic										
LOC 1, Km 0+000, NH 102	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91	-
LOC 2, Km 9+900, Porompat DC Road	0.89	0.84	0.88	0.42	1.2	1.2	0.8	0.23	0.19	-
LOC 3, km 13+200, Lamlong-Tinsid Road	1.21	0.98	0.84	0.75	0.79	0.85	0.91	1.3	-	-
LOC 4, km 47+900, NH 2	1.8	1.65	1.5	1.2	1.45	1.8	1.7	1.8	1.6	-

The factors given in the table above are multiplicative; hence factors >1 will increase the revised traffic whereas those <1 will reduce the estimated traffic of ring road. The factors for cars are generally >1 or close to 1. This shows that growth of car/taxi has increased. Percentage increase and decrease for all the mode is in the range of ± 20 . Moreover, few categories of vehicles categories have growth rate in the range of ± 10 which is quite acceptable in the projection. At location 4, factors are comparatively higher due to the presence of Airport on this road. Traffic on the airport road is higher due to pent demand which get released after COVID restriction.

The factors adopted for estimation of revised traffic in the present year 2022 on Ring Road is presented in **Table 0.5**

Table 0.5: Traffic Revision factors for Proposed Ring Road Sections

	Car	Two Wheeler	Three Wheeler (Passenger)	Bus & Mini-Bus	LGV 3 Wheeler	LGV 4 Wheeler	2-Axle Truck	3-Axle Truck	MAV
HS-1	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91
HS-2	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91
HS-3	0.89	0.84	0.88	0.42	1.2	1.2	0.8	0.23	0.19
HS-4	0.89	0.84	0.88	0.42	1.2	1.2	0.8	0.23	0.19
HS-5	1.21	0.98	0.84	0.75	0.79	0.85	0.91	1.3	-
HS-6	1.21	0.98	0.84	0.75	0.79	0.85	0.91	1.3	-
HS-7	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91

	Car	Two Wheeler	Three Wheeler (Passenger)	Bus & Mini-Bus	LGV 3 Wheeler	LGV 4 Wheeler	2-Axle Truck	3-Axle Truck	MAV
HS-8	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91
HS-9	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91
HS-10	1.80	1.65	1.50	1.20	1.45	1.80	1.70	1.80	1.60
HS-11	1.80	1.65	1.50	1.20	1.45	1.80	1.70	1.80	1.60
HS-12	0.98	1.07	0.84	0.9	0.98	0.98	0.88	0.96	0.91

Using the traffic revision factors given above the present and then the future traffic estimates have been revised for proposed ring road sections as presented in the next sub-section.

The projected traffic is given in **Table 0.6**.

Table 0.6: Estimated Annual Average Daily Traffic (AADT) for Proposed Ring Road

Year	HS-1		HS-2		HS-3		HS-4		HS-5		HS-6	
	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU
2022	49851	32967	29986	17936	46886	32954	31840	19184	13176	14808	12264	11440
2023	53214	35116	32036	19126	50018	35084	34008	20466	14009	15681	13069	12141
2024	56805	37408	34227	20396	53360	37354	36324	21835	14895	16606	13927	12887
2025	60852	39986	36698	21827	57124	39906	38935	23377	15891	17641	14892	13723
2030	89745	58377	54348	32041	83989	58103	57581	34380	22985	25012	21780	19681
2035	125106	80619	76066	44488	116729	80016	80471	47797	31461	33605	30125	26736
2040	166715	106716	101702	59167	155151	105616	107434	63553	41360	43669	39920	35023
2045	215052	136979	131563	76264	199680	135188	138781	81829	52799	55361	51281	44662
2050	277450	175880	170206	98323	257047	173105	179291	105380	67427	70216	65891	56976

Year	HS-7		HS-8		HS-9		HS-10		HS-11		HS-12	
	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU	VEH	PCU
2022	45171	47081	38287	35546	7805	6459	3914	3419	4122	3522	28198	25383
2023	48034	49889	40737	37719	8326	6877	4171	3629	4394	3739	30014	26946
2024	51081	52869	43346	40029	8881	7323	4445	3852	4683	3970	31947	28607
2025	54503	56205	46277	42618	9507	7824	4754	4102	5009	4229	34122	30470
2030	78891	79966	67169	61061	13969	11395	6954	5887	7337	6075	49618	43741
2035	108037	107762	92203	82802	19402	15698	9623	8001	10162	8265	68233	59427
2040	142014	140162	121315	107963	25778	20740	12755	10478	13481	10833	89913	77611
2045	181203	177613	154804	136814	33168	26579	16389	13353	17332	13813	114882	98490
2050	231300	225188	197619	173480	42682	34070	21064	17026	22289	17622	146840	125057

0.8 IMPROVEMENT Proposal

Based on the discussion with stake holders and the recommendations for widening as per IRC -106 "Capacity of Roads in Urban Areas", the improvement proposal for the various homogenous sections for the proposed ring road is given in **Table 0.7**.

Table 0.7: Improvement proposal of Proposed Ring Road

Homogenous Sections	Revised Chainage (km)		Improvement Proposed in consultation with client and other stakeholders
	From	To	
HS-1	0+000	2+200	2 Lane
HS-2	2+200	7+000	2 Lane
HS-3	7+000	10+815	4 Lane
HS-4	10+815	14+715	2 Lane
HS-5	14+715	14+960	No Improvement (NH-150)
HS-6	14+960	25+980	2 Lane
HS-7	25+980	32+125	No Improvement (NH-39)
HS-8	32+125	33+575	2 Lane
HS-9	33+575	42+875	2 Lane
HS-10	42+875	44+430	2 Lane
HS-11	44+430	48+335	4 Lane
HS-12	48+335	54+155	2 Lane

As per analysis given in Chapter 4, some sections of road need improvement to better facility. However, the development proposal has been decided in consultation with the stake holders based on the importance of the connectivity nodes. In future if the demand will further increase, Govt. of Manipur will initiate further development.

0.9 SOIL AND MATERIAL INVESTIGATIONS

As part of the project study, the Consultants carried out Soil and Material Investigations, analysis of existing sub-grade soil properties as well as investigation on sources of available construction materials for the proposed construction works concerning to embankment sub-grade, sub-base and top layers (bituminous/concrete) of road pavement as per TOR.

About 15 borrow area have been identified for embankment filling. 2 stone quarries and 3 sand sources have been identified in the close vicinity of the project.

The investigations and study conducted by the consultant covered all the relevant aspects of the Study.

0.10 PAVEMENT DESIGN & COMPOSITION

The existing pavement is flexible. The pavement composition comprises of bituminous laid over a layer of WBM and boulder. In majority section the existing

pavement is very poor condition. Based on an analysis of the various CBR values of identified borrow soils and the in-situ condition of the subgrade soil, the design sub-grade CBR has been adopted as per the **Table 0.8**.

Table 0.8: Recommended Sub-grade CBR

Homogenous Sections	Section Details (km)			Design CBR (%)	Lane Configuration
	From	To	Length		
HS-1	0+000	2+200	2.2	10	2 Lane
HS-2	2+200	7+000	4.8		2 Lane
HS-3	7+000	10+815	3.815		4 lane
HS-4	10+815	14+715	3.900		2 lane
HS-5 (NH-150) (Out of present Scope)	14+715	14+960	0.245		
HS-6	14+960	25+980	11.02	8	2 Lane
HS-7 (NH-39) (Out of present Scope)	25+980	32+125	6.145		
HS-8	32+125	33+575	1.45	8	2 Lane
HS-9	33+575	42+875	9.3		2 Lane
HS-10	42+875	44+430	1.525		2 lane
HS-11	44+430	48+335	3.935		4 Lane
HS-12	48+335	54+155	5.820		2 Lane
Spur-1	0+000	1+570	1.57	7	4 Lane
Spur-2	0+000	0+815	0.815	7	2/4 Lane
Spur-3	0+000	1+080	1.08	7	2 Lane

Based on the life cycle cost analysis, flexible pavement has been recommended. The pavement composition is evaluated as per design charts provided in IRC: 37-2018 and the recommended pavement composition for new flexible pavement construction and overlay for a design life of 20 years are presented in **Table 0.9**.

Table 0.9: Recommended Pavement Composition

New Chainage (Km)		Total Length (Km)	Conventional Pavement Composition				GeoCell Pavement Composition (WMM Reinforcement)				Flexible Pavement with Stabilized Granular layer Composition				
From	to		BC	DBM	WMM	GSB	BC	DBM	WMM	GSB	BC	DBM	SAMI	CTB	CTSB
0.000	1.600	1.6	-	-	-	-	-	-	-	-	40	60	-	200	200
1.600	2.200	0.6	-	-	-	-	-	-	-	-	40	60	-	180	200
2.200	7.000	4.8	-	-	-	-	40	50	200	200	-	-	-	-	-
7.000	10.815	3.815	-	-	-	-	-	-	-	-	40	50	-	190	200
10.815	11.300	0.485	-	-	-	-	-	-	-	-	40	50	-	170	200
11.300	14.715	3.415	-	-	-	-	40	50	200	200					
14.715	14.960	0.245	-	-	-	-	-	-	-	-	-	-	-	-	-
14.960	18.555	3.595	-	-	-	-	-	-	-	-	40	60	-	200	200
18.555	20.700	2.145	-	-	-	-	40	100	200	200	-	-	-	-	-
20.700	23.430	2.73	-	-	-	-	-	-	-	-	40	60	-	200	200
23.430	25.980	2.55	-	-	-	-	-	-	-	-	40	60	-	200	200
25.980	32.125	6.145	-	-	-	-	-	-	-	-	-	-	-	-	-
32.125	33.575	1.45	40	130	250	200	-	-	-	-	-	-	-	-	-
33.575	38.425	4.83	-	-	-	-	-	-	-	-	40	50	-	170	200
38.425	42.875	4.45	40	90	250	200	-	-	-	-	-	-	-	-	-
42.875	44.450	1.555	40	90	250	200	-	-	-	-	-	-	-	-	-

New Chainage (Km)		Total Length (Km)	Conventional Pavement Composition				GeoCell Pavement Composition (WMM Reinforcement)				Flexible Pavement with Stabilized Granular layer Composition				
From	to		BC	DBM	WMM	GSB	BC	DBM	WMM	GSB	BC	DBM	SAMI	CTB	CTSB
44.430	44.780	0.35	-	-	-	-	-	-	-	-	40	50	-	170	200
44.780	46.575	1.795	-	-	-	-	-	-	-	-	40	50	-	170	200
46.575	48.335	1.76	-	-	-	-	40	50	200	200	-	-	-	-	-
48.335	53.815	5.480	-	-	-	-	40	50	200	200	-	-	-	-	-
53.815	54.155	0.34	-	-	-	-	40	50	200	200	-	-	-	-	-
Spur 1															
0.000	1.570	1.57	-	-	-	-	-	-	-	-	40	50	-	190	200
Spur 2															
0.000	0.810	0.81	40	90	250	200	-	-	-	-	-	-	-	-	-
Spur 3															
0.000	1.080	1.08	-	-	-	-	-	-	-	-	40	50	-	170	200

0.11 IMPROVEMENT PROPOSAL

Based on the traffic forecast and interaction with the client, the project road has been proposed to be improved to 4 lane with service lane, 4 lane without service lane and 2 lane standards in different sections. The alignment of the project road has been designed to design speed of 80kmph in green field and improved to 50/40/30 kmph in existing road section depending upon the ROW, existing geometrics and impact on habitation along existing road.

Table 0.10: Improvement Proposal

Name of the road	Total Alignment Length (in Km)	Common Portion with NH/AHI (in Km)	Total length proposed for improvement (in km)	length of existing road	length in Green field	4 lane/4 lane with slip/ Track road	2 lane/2 lane+ PS
Ring Road	54.155	6.390	47.765	29.995	17.770	7.720	40.045
Spur-1	1.570	-	1.570	1.570	-	1.570	
Spur-2	0.815	-	0.815	0.815	-	0.160	0.655
Spur-3	1.080	-	1.080	1.080	-	-	1.080

0.12 NEW PROPOSED BRIDGES/ STRUCTURES

As per the proposed alignment, the following new bridges and structures have been proposed keeping in view the condition of existing bridges, hydrological requirement, proposed improvement / realignment of road, road junctions and road crossings. There are 3 Major Bridges, 6 Minor Bridges, 1 Vehicular underpass and 1 Flyover.

Table 0.11: Structure Proposal

New 4-lane / Additional 2-lane bridges	Qty.	Length (m)
• New 2-lane bridges	3	75.05, 11.802, 35.255
• New 2-lane bridges in realignment/ replaced	3	20.05, 8.314, 64.569
• New 4-lane bridges	2	44.05, 63.554
• New 2 lane underpass	1	26.223
• New 4 lane flyover	1	43.553
• New Minor Bridge on Junction	1	8.800
Total	11	

0.13 PROPOSED ROBS/FLYOVERS/INTERCHANGES/UNDERPASS

There is no railway line crossing on the proposed alignment, therefore no ROB is required. However one 4-lane flyover and one 2-lane Vehicular underpass have been proposed as per project requirement keeping in view the site conditions, existing road junctions and cross roads for smooth and effective flow of traffic. The details of the grade separated structures are given in **Table 0.12**.

Table 0.12: Details of proposed Flyover/Underpass

S. No.	Type of structure	Location km. (Design Chainage)	Span Arrangement (m)	Remarks
1.	Flyover	47+863	1 x 43.50	New 4-lane flyover over NH-150 with vertical clearance of 6m
2.	Vehicular Underpass	51+861	2 x 12.0 (clear opening)	New 2-lane VUP over SH-10 with vertical clearance of 6m

0.14 PROPOSED CULVERT

For improvement of Imphal Ring Road, details of culverts to be widened / proposed /reconstructed are as below:

Table 0.13: Proposed Culvert

Main Ring Road		SPUR	Junction/ cross road
Box	Hume Pipe	Box	Hume
137	36	11	88

0.15 PROJECT FACILITIES

Service Lane/Slip Road

Considering proper turning movement near proposed Flyover on NH 2, both side slip roads (km 47+475 to km 48+335) have also been proposed 0.86 km on each side.

Footpath

Since the proposed project is a urban ring road and, the ring road passes through congested market area, to facilitate the pedestrian movement along the ring road and considering traffic safety 1.5m/2.0m width Drain with utility corridor cum footpath has been proposed. A length of about 10.312 Km (LHS+RHS) of ring road where either open lined drain or footpath has been proposed. Drain cum utility corridor has been proposed in all other stretches including spurs.

Median and Median Opening

Due to land constraint 0.5m width of New Jersey type Crash barrier has been proposed in 4 lane Sections to segregate traffic median opening of 20 m length at 6 locations have has been considered at various location for cross passage.

Bus Lay Bye

To address the need of people living along the project road, bus lay bay have been proposed. Due to land constraint, each Bus bay of 4.5m width and 15m long with shelter has been proposed as per IRC 86:1983. A total of 23 nos Bus bays with bus shelters has been proposed.

Truck Lay Bye

As Imphal ring road is within Imphal city, provision of truck lay bye is not required.

Public Facilities

In addition to improvement of road for better connectivity, to facilitate the local inhabitant, community centre at 30 locations, public convenience at 20 locations, market sheds at 10 locations and public amenities at 14 locations have been proposed as per demand.

0.16 PROPOSED RIGHT OF WAY

To accommodate, the improvement proposal of Imphal Ring Road, Proposed Right of Way (PROW) has been proposed as 14 m in general for 2 lane section and 18.5m for 4 lane section. However, due to provision of both side slip roads for proposed Flyover on NH 150, the PROW has been proposed as 35m. In addition to above additional land for improvement of Major Junctions, Bus bay, Bridge approaches and hill sections have been proposed. The details of PROW are as follows.

Table 0.14: PROW Details

Sl. No.	Stretches (Km)		Minimum PROW Width (m)
	From	To	
1	0+000	7+000	14.00
2	7+000	9+885	18.50
3	9+885	10+815	35.00
4	10+815	14+715	14.00
5	14+960	15+145	14.00
6	15+145	15+915	13.50
7	15+915	16+815	14.00
8	16+815	17+265	15.40
9	17+265	18+500	14.00
10	18+500	20+600	16.80
11	20+600	23+643	14.00
12	23+643	24+305	16.80
13	24+305	25+980	14.00
14	32+125	32+620	14.00
15	32+620	33+050	10.50
16	33+050	33+575	14.00
17	33+575	42+875	14.00

Sl. No.	Stretches (Km)		Minimum PROW Width (m)
	From	To	
18	42+875	44+430	14.00
19	44+430	47+475	18.50
20	47+475	48+335	35.00
21	48+335	50+950	14.00
22	50+950	52+155	17.00
23	52+155	54+155	14.00
SPUR1	0+000	1+570	18.50
SPUR2	0+000	0+655	14.00
SPUR2	0+655	0+815	18.50
SPUR3	0+000	1+080	14.00

0.17 DETAILED COST ESTIMATE

Unit Rates

The unit rates are based on Schedule of Rates 2022 of Public Works Department, Manipur. For road embankment borrow areas have been identified along the project road. For stone metal, quarries have been identified along the road. Average lead has been worked out for earth and stone metal and cartage cost as per State Schedule of Rates. The unit rates have been worked out by taking the cost of materials as provided in the State Schedule of Rates (except for steel and bitumen for which market rates has been considered).

Steel rates have been taken as per Manipur Schedule of rates -2022. Bitumen rates have been taken from Haldia refinery as per IOCL rates for the last fortnight of August 22.

As per MoRT&H New Data Book of 2019 the projects have been categorized into large/medium/small projects. Based on project provisions and cost parameter this project has been categorized into medium project and rate analysis worked out as per medium project components of Standard Data Book.

The machinery/equipment for medium scale projects provisioned in MORTH data book is different from regular/routine machinery which has been in utilization for present highway works since long time. The output of this machinery is moderate and hire charges is also premium compared to regular machinery. To complete the projects in stipulated timelines the moderate machinery is provisioned for medium scale project. Like that for large and small projects also the machineries are categorized.

The rates of hire charges of Machinery have been considered as per Manipur Schedule of Rates 2022. However, the rates of Machinery which are not available in Schedule of Rates are taken from Standard Data Book 2019 with escalation of 5% each year. The component of labour, material and machinery has been taken

from the Standard Data Book of the Ministry of Road Transport and Highways (Second Revision 2019).

Detailed Estimate

Quantities of earthwork have been worked out from Highway design software-MX Quantities of pavement and other components of road have been worked out manually from detailed drawings and TCS.

Quantities for bridges and culverts have been worked out from their detailed drawings.

Estimation of allowances for contingencies and supervision charges as percentage of civil cost.

Project Cost

The Project Cost for improvement of Imphal Road is given as follows:

Table 0.15: Project Cost

Phase and Length (In Km)	Civil Cost (In INR Cr.)	Per Km Civil Cost (In INR Cr.)	Total Project Cost (In INR Cr.)	Per Km Total Project Cost (In INR Cr.)
Package 1				
Package 2				
Package 3				

0.18 ECONOMIC ANALYSIS

The annual cost and benefit streams are used to derive the net cash flow for the project. The EIRR (Economic Internal Rate of Return) and NPV (Net Present Value) for both scenarios at 12% discount rate are determined using the discounted cash flow technique for all the Sections and are given in **Table 0.16**.

Table 0.16 : Result of Economic Evaluation

S. No.	Description	Base case (EIRR) %	Sen-1 (EIRR)	Sen-2 (EIRR)	Sen-3 (EIRR)
			Base Costs and Base Benefits minus 15%	Base Costs plus 15% and Base Benefits	Base Costs plus 15% and Base Benefits minus 15%
1	Alternative-1 (2LPS & 4L)	13.79%	11.90%	11.76%	10.05%
2	Alternative-2 (Entire 2LPS)	10.84%	8.81%	9.03%	7.18%
3	Alternative-3 (Entire 4L)	14.92%	12.97%	12.81%	11.03%

The Economic Analysis has been done for the Flexible Pavement using HDM-4 for Imphal Ring Road. Results of economic analysis tabulated above indicate that the alternative 1 and 3 of the project roads are economically viable in base case as EIRR is more than 12%.

Based on the analysis above, it is concluded that the investment on the said project is economically viable, is a worthwhile and justified investment for the development of Project Road Influence areas. Alternative 1 is recommended seeing the better EIRR and other strategic improvements in region.

Impact of Co₂ emissions is also evaluated. As project is giving alternative route to the through traffic avoiding congested city area and it would also attract suppressed traffic from less connected region. Hence there will be diverted traffic from congested route but at the same time it will add additional traffic in system. It has been observed after quantification of Co₂ that Co₂ emission are marginally increased with operations of project in long run as traffic numbers are almost doubled compared to do nothing scenario. Quantified Co₂ emissions have been converted in monetary values based upon the unit value provided in clause 163 of ADB guidelines of economic analysis. Result of the economic analysis including Co₂ emission indicates that there are marginal increase in EIRR

0.19 RECOMMENDATIONS

- Out of a total length 47.765 km to be improved as Ring road, about 7.72 km is recommended as 4 lane divided carriageway / 4 lane divided carriageway with slip road/ cycle track and 40.045 km is recommended as 2 lane with paved shoulder/ 2 lane/ 2 lane with Cycle track excluding common portion with AH-1 and NH-202. The proposal also involves 3 Spurs, one connecting DDK in Porompat (1.57 km-4 lane), Spur to RIMS (out of 0.815km length, 0.160km 4lane and 0.655km 2 lane) & Spur to FCI Go-down (1.08 km-2 lane)
- The new pavement has been designed in accordance with the IRC: 37-2018. The guidelines recommend that flexible pavements are recommended for a life of 20 years.
- It is suggested that soil from borrow areas which have shown a soaked CBR in the range of 8% - 10% or more be considered for subgrade construction
To increase the elastic modules of wet mix macadam and to economise the pavement, Geo-Cell have been proposed in WMM layer.
- To facilitate smooth uninterrupted movement of traffic and improved safety a flyover at Ch. 47+863 along with slip roads is recommended for junction with NH-2 (old NH-150) also a VUP structure at Ch. 51+861 for junction with SH-10 is recommended.
- Considering the quantum of land acquisition, progress of land acquisition and early completion, the project has been bifurcated in three packages for execution.
- Results of economic analysis indicates that the project is economically viable in base case and all case of sensitivity as EIRR is more than 12%.

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