CHAPTER - 6

Design Standards & Report

CHAPTER 6 : DESIGN & REPORT

6.1 Design standard & specifications

DESIGN PHILOSOPHY

The stretch of road from Seppa to Khodaso (110.45 km) is proposed to be improved to National Highway Standard / Specifications. The project road will have two-lane carriageway facility. The design philosophy that will be followed embodies the following:

- The facility should be of National Highway standards
- The facility must meet the needs for development activities in the region.
- Travel should be safe, with in built engineering features
- The facility should be aesthetically pleasing and should not be visually intrusive
- The facility should meet the environment conditions

Design Standards for the highway requirements have been framed for providing the desirable level of service and safety. For this Project it is proposed to follow Design Standards given in IRC Standards, Codes, Guidelines and Special Publications besides MORT&H circulars and specifications as applicable to National Highways. In the absence of any definite provision on any particular issue, the following standards shall be referred to in that order.

- Bureau of Indian Standards
- American Association of State Highway and Transport Officials (AASHTO)
- American Society of Testing Materials (ASTM)
- British Standards
- Any other National or International Standard as considered suitable

SPECIFICATIONS

The material to be used in the Project work (including facilities there on) shall conform to MORT&H Specifications for Road & Bridge Work 4th Rev. 2001. Where these specifications are silent in regard to certain specifications for the material in question, specifications under Bureau of Indian Standard/AASHTO/ASTM/BS shall apply in that order.

GEOMETRIC DESIGN STANDARDS

For this Project Highway, Geometric Design Standards shall be as per the following:

- IRC: 73-1980 shall be generally followed.
- IRC: SP: 19-2001: manual for survey, investigations and preparation of road projects.
- IRC: 52: Recommendation about the alignment survey and Geometric Design of Hill Roads (Second Revision).
- IRC - SP – 48- 1998: Hill Road Manual

Altitude of the road

Altitude of the Project Road lies between 263 m to 1100 m above the MSL

Terrain Classification:

This Road Corridor is generally in mountainous terrain.

Design Speed:

Road Classification	Mountainous Terrain	
	Ruling	Minimum
National Highway	50	40

The ruling design speed should generally be the criterion for correlation of the various design features. Minimum design speed may be adopted in sections where site conditions or economic do not permit a design based on the ruling design speed.

Cross Section Elements:

- Right of Way (ROW)

IRC: 73-1980 Table recommends the following land width for National Highway:

Sl. No.	Road Classification	Mountainous and Steep Terrain		Exceptional
		Open areas	Built-up areas	
		Normal	Normal	
1	National Highways	24 m	20 m	18 m

The existing ROW along the project road is not uniform. The width of ROW is not defined in the road. ROW at 24/20m will be maintained. However there are stretches where the ROW has been temporarily encroached. It would require restoration to 24m width.

Roadway Details

- Total Road Width

Total roadway width shall be 12.00 m.

- Carriageway Width

The National Highway shall be designed as a two lane carriageway. The width of two lane shall be 7.0m.

- Shoulder

By the side of the carriageway on both sides, there shall be a paved shoulder of 2.5m width.

- Cross-slope

Each carriageway shall have cross slope of ;2.50 per cent

The shoulder shall have a slope of 3.5 per cent.

Stopping Sight Distance:

Sufficient stopping distance is made available for drivers to stop their vehicles when faced with an unexpected obstruction in the carriageway. The safe stopping sight distance and overtaking sight distance as recommended in the manual is as below:

Speed (Km/h)	Safe Stopping Sight Distance (m)	Intermediate Sight Distance (m)
20	20	40
25	25	50
30	30	60
35	40	80
40	45	90
50	60	120

Horizontal Alignment:

- Super elevation

No super elevation is proposed when its value obtained is less than the road camber e.g. radii beyond which super elevation is not proposed are as mentioned below.

Radius beyond which super elevation not required

Design speed (km/hr)	Radii (Meters) For Camber of					
		4%	3%	2.5%	2%	1.7%
20	Proposed as per IRC:SP:48-1998	50	60	70	90	100
25		70	90	110	140	150
30		100	130	160	200	240
35		140	180	220	270	320
40		180	240	280	350	420
50		280	370	450	550	650

- Radius

Radii for horizontal curves corresponding to ruling minimum and absolute minimum design speeds are as given below: (As per IRC: SP: 48-1998)

Minimum Radius for National Highways

Mountainous Terrain	
Ruling Min Radius (m)	Absolute Minimum Radius (m)
80	50

There will be corresponding speed limit in case the radii is less than the above due to hill physical features and economic consideration.

Widening of Pavement at Curves

At sharp horizontal curves, it is necessary to widen the carriageway to facilitate safe passers of vehicle. Extra width to be provided on horizontal curve is given below (refer clause 6.8.5 of IRC: SP: 48: 1998).

Radius of Curve (m)	Upto 20°	20 to 40	41 to 60	61 to 100
Extra width (m) 2 Lane	1.5	1.5	1.2	0.90

Wherever the radius is less than the specified minimum design speed, the transition curve, super elevation and pavement widening will be introduced. This will minimise the intrusion of vehicles on to adjacent lanes, tend to encourage uniformity of speed and increase vehicle speed at the curves.

Transition Length

Transition length is given in Table below:

Transition Length of Curve
As per IRC: SP: 48-1998

Curve Radius (m)	Design Speed Km/h				
	50	40	30	25	20
15				NA	30
20				35	20
25			NA	25	20
30			30	25	15
40		NA	25	20	15
50		40	20	15	15
55		40	20	15	15
70	NA	30	15	15	15
80	55	25	15	15	NR
90	45	25	15	15	
100	45	20	15	15	
125	35	15	15	NR	
150	30	15	15		
170	25	15	NR		
200	20	15			
300	15	NR			
400	15				
500	NR				

NA-Not Applicable

NR-Transition not required

Vertical Alignment:

- Codal Provisions

The gradients to be maintained in the design are as per following guidelines :

Codal Reference	Clause No.
IRC : SP-48 – 1998, Hill Road Manual	12.2.1
IRC :SP-52-2001, Recommendations about Alignment Survey and Geometric Design of Hill Roads	6.9.1.3

- Gradients for Different Terrain

Sl. No	Terrain	Ruling gradient	Limited gradient	Exceptional gradient
1	Steep terrain up to 3,000 m height above mean sea level	6% (1 in 16.7)	7% (1 in 14.3)	8% (1 in 12.5)

- Gradients upto the ruling gradient may be used as a matter of course in design (Ref. Clause No. 6.9.1.4 of IRC-SP: 48 – 1998).

- The limiting gradients may be used where the topography of a place compels this course or where the adoption of gentler gradients would add enormously to the cost. In such cases, the length of continuous grade steeper than the ruling gradient should be as short as possible. (Ref. Clause No.6.9.1.5 of ;IRC-SP:48 – 1998)

- Exceptional gradients are meant to be adopted only in very difficult situations and for short lengths not exceeding 100 m at a stretch. Successive stretches of exceptional gradients must be separated by a minimum length of 100 m having gentler / flatter gradient (Ref. Clause No. 6.9.1.6 of IRC-SP: 48 – 1998).

- Vertical Curves

Minimum length of Vertical Curve ;(As per IRC: SP: 48-1998)

Design speed km/h	Maximum grade change (percent) not requiring a vertical curve	Minimum Length of vertical curve (m)
35	1.5	15
40	1.2	20
50	1.0	30

The actual length for the vertical curve shall how ever be provided as per IRC: 73-1980

Side Slope Formation in Cutting

The following values are adopted as per IRC: SP: 48:1948 Clause 7.4.

Side Slope in Cutting

SL.No.	Item	Slopes of cutting
1	Ordinary Soil/ Heavy soils	1:1
2	Ordinary /Soil Rock	¼ : 1
3	Hard rock	80º to 90º

(Explanation: The Slope 1:1 signifies 1 in the horizontal direction and 1 in the vertical)

ROAD FURNITURE

Km Stones

Km Stones, 200m stones and 5th km stones shall be provided as per codal provisions of IRC:8-1980.

Road Signs:

All signs shall be placed on the valley side of the road. Where extra emphasis is warranted, they may be duplicated on the right hand side as well, as per IRC: 67-1977. The extreme edge of the sign shall be not less than 2m from the edge the carriageway.

Road Marking:

Provisions shall be made for centre line making with thermo- plastic paint as per IRC:35-1970.

Route Marker Signs for National Highways

The design, location, materials, definitions plate, route marker assembly at junctions with numbered routes, colour of back sign of port and inscription will be done as per IRC: 2-1968. Centre-line marking for a 2-Lane Road shall be provided.

Standard letters and numerals of different heights for use on highways signs :

The shape, spacing in between and use of letters / numerals of different heights for use on highway signs shall be as per IRC: 30-1968.

Numbering of bridges and culverts :

The materials method of numbering, manner of inscription and placing of numbering of culverts and bridges shall be as per IRC: 7-1971.

Street Furniture

A modern highway facility requires a number of items of street furniture. The provisions of these shall be made on the basis of recent Guidelines evolved under the Ministry of Road Transport & Highway's Research Project R-63: "Development of Aesthetic Design for Road side Furniture". The provision of these considerations is based generally on:

1. The designs are aesthetically pleasing and blending with the surrounding environment.
2. They are utilitarian.
3. They do not intrude into the overall appearance of the facility.
4. The materials and specifications adopted are of a high quality so that their maintenance
   is minimum.
5. They enhance the safety of travel.

BRIDGES & CULVERTS

- All Cross Drainage structures shall be classified as culverts, minor bridges & major bridges depending on the length of the structure as per IRC standards. Structure up to 6m length fall into the category of culverts, more than 6m but up to 60m in length as minor bridges and beyond 60m length as major bridges.

- The deck width is required to be kept the same as that of the roadway for 2-lanes

- The bridge components shall be designed at least with 2-lanes of class 'A' loading or one lane of class 70R loading.

- The list of IRC codes given below but not limiting to, shall be referred during formulation of the design and drawing of ridges.

List of IRC Codes

IRC: 5-1998	Standard Specification & Code of practice for Road Bridges. Section-I General features of Design (Seventh Revision)
IRC: 6-2000	Standard Specification & Code of practice for Road Bridges. Section-II Loads & Stresses (Fourth Revision)
IRC: 18-2000	Design Criteria for Prestressed Concrete Road Bridges. (Post-Tensioned Concrete) (Third Revision)
IRC: 21-1997	Standard Specification & Code of practice for Road Bridges. Section – III Cement Concrete Plain & Reinforced (Second Revision)
IRC: 22-1986	Standard Specification & Code of practice for Road Bridges. Section – VI Composite Construction (First Revision)
IRC: 24-2001	Standard Specification & Code of practice for Road Bridges. Section – V Steel Road Bridges (Second Revision)
IRC: 45-1972	Recommendations for Estimating the Resistance of soil below the maximum Scour Level in the Design of Well Foundation of Bridges.
IRC: 73-1980	Geometric Design standards for Rural (Non-Urban) Highways.
IRC: 78-1983	Standard Specification & Code of practice for Road Bridges. Section – VII Foundation & Substructure (First Revision)
IRC: 83-1999	Standard Specification & Code of practice for Road Bridges. Section – IX Bearings, Part-I Metallic Bearings (First Revision)
IRC: 83-1987	Standard Specification & Code of practice for Road Bridges. Section – IX Bearings, Part-II Elastomeric Bearings
IRC: 89-1997	Guidelines for Design & Construction of River training & control works for road bridges.
IRC: SP:33-1989	Guidelines on supplemental Measures for Design, Detailling & Durability of Important Bridge Structures.

Design loads

- Dead Loads:

Apart from all the actual dead loads, irrespective of the type of wearing coat and crash barrier proposed, the structure shall be designed to allow for

- Wearing coat load = 2 kN/m².
- RCC crash barriers P1 type as per IRC: 6-2000.

- Live Loads :

The bridge shall be designed to carry one lane of Class 70R for every two lanes with one lane of Class A for the remaining lanes, if any ,or one lane of Class A for each lane.

- Seismic Effects:

(i) Basic horizontal seismic co-efficient-As per zone V (Table 5& fig11of IRC:6- 2000)

(ii) Importance Factor - 1.5
Reinforcement detailing of structures shall conform to the provision of IS 13920

(iii) Soil Foundation factor ß= 1.0 for pile foundations

- Loading due to Crash barrier: As per Table 3 of IRC: 6 2000

- Temperature Effect:

(i) Temperature stresses to be worked out as per Clause 218 of IRC: 6-2000
For design of structure, the temperature range to account for temperature effect shall be:
In the present case t = +/- 25º C

(ii) The superstructures shall also be designed for effects of distribution of temperature across the deck depth . For calculation of thermal forces effect of 'E' value of concrete should be taken as 50% of the instantaneous value as to account for effects of creep on thermal strains.

- Differential Settlement: 6 mm with instantaneous E value of concrete. This will be deemed to cover lifting of superstructure also.

PAVEMENT DESIGN

Design for new pavement has been carried out in accordance with the latest version of IRC: 37-2001. The road shall be designed for flexible pavement.

The National Highway 52 in Assam acts as the major arterial route for Arunachal Pradesh. In the absence of any transverse road link within the State, all the vehicles from Tawang, West Kameng & East Kameng districts, bound for Itanagar and other places on the north bank of river Brahmaputra, have to come down to Assam and follow NH-52. The proposed road is expected to attract this volume of traffic. A traffic count for three days had been carried out at Bhalukpong and Seppa to have a fair idea of the likely traffic, which is attached as Annexure 'I'.

For estimating purposes, the following pavement thickness has been adopted, which can be suitably modified during preparation of DPR, after necessary soil tests etc.

Carriageway for 7 metres:

GSB layer	:	250	mm
WMM layer	:	200	mm
DBM layer	:	60	mm
Wearing course	:	40	mm

Shoulders:

GSB layer	:	400	mm
WBM Grade II	:	75	mm
WBM Grade II	:	75	mm

Slope Protection Work

The slope protection work includes the following :

- Retaining Wall
- Breast Wall

It is proposed to provide minimum number of structures keeping in view the economy, cost as well the essentiality of the requirement. Construction shall be as per IRC:SP-20.

DRAINAGE

- An effective drainage system of road shall be designed as per stipulation of IRC SP: 42-1994.

- The road side channel will be trapezoidal/ rectangular of adequate capacity to carry 100% surface runoff of drainage area of highway ROW. It will be drained to the nearest available natural water course .It is proposed to adopt trapezoidal section as space is not a constraint and it is more efficient and economical. This will be lined drain to drain out in the defined outfall points. V shapes unlined drain will be adopted in the hard rock hill sections

- The superstructure of bridges shall be drained with suitable drainage spouts.

TRAFFIC SAFETY MEASURES

The design layout and materials chosen for the safety barrier shall suitably blend with the surrounding and shall further conform to MORT&H circulars.

TRAFFIC COUNT AT SEPPA

Annexure - I

Dated & Month	Time Hour		Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From	To		Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)	2(b)	3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
15/4/08	7.00 Am	8.00 Am	Up	10	4	9	23	-	3	-	-	-	3	
			Down	5	2	1	8	-	2	-	-	-	2	
	8.00 Am	9.00 Am	Up	6	2	6	14	-	-	-	-	-	-	
			Down	5	-	2	7	-	-	-	-	-	-	
	9.00 Am	10.00 Am	Up	6	4	6	16	-	2	-	-	-	2	
			Down	4	2	4	10	-	3	-	-	-	3	
	10.00 Am	11.00 Am	Up	8	6	2	16	-	1	-	-	-	1	
			Down	5	4	3	12	-	1	-	-	-	1	
	11.00 Am	12.00 Am	Up	8	6	4	18	-		-	-	-		
			Down	9	4	2	15	-	2	-	-	-	2	
	12.00 Am	1.00 Pm	Up	4	2	4	10	-	-	-	-	-	-	
			Down	3	2	3	8	-	-	-	-	-	-	
16/4/08	1.00 Pm	2.00 Pm	Up	5	2	3	10	-	-	-	-	-	-	
			Down	2	3	6	11	-	-	-	-	-	-	
	2.00 Pm	3.00 Pm	Up	4	2	3	9	-	-	-	-	-	-	
			Down	2	1	4	7	-	-	-	-	-	-	
	3.00 Pm	4.00 Pm	Up	4	2	2	8	-	-	-	-	-	-	
			Down	3	4	4	11	-	-	-	-	-	-	
	4.00 Pm	5.00 Pm	Up	5	3	2	10	-	-	-	-	-	-	
			Down	7	5	6	18	-	2	-	-	-	2	
	5.00 Pm	6.00 Pm	Up	8	3	2	13	-	-	-	-	-	-	
			Down	5	4	6	15	-	-	-	-	-	-	
	6.00 Pm	7.00 Pm	Up	5	2	6	13	-	-	-	-	-	-	
			Down	2	4	2	8	-	-	-	-	-	-	
	7.00 Pm	8.00 Pm	Up	3	2	2	7	-	-	-	-	-	-	
			Down	2	2	2	6	-	-	-	-	-	-	
	8.00 Pm	9.00 Pm	Up	2	1	-	3	-	-	-	-	-	-	
			Down	2	2	2	6	-	-	-	-	-	-	
	9.00 Pm	10.00 Pm	Up	2	1	-	3	-	-	-	-	-	-	
			Down	2	2	2	6	-	-	-	-	-	-	
	10.00 Pm	11.00 Pm	Up	-	-	1	1	-	-	-	-	-	-	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
					Down	2	1	1	4	-	1	-	-	-	1	
	11.00	Pm	12.00	Pm	Up	2	-	2	4	-	-	-	-	-	-	
					Down	-	-	-	-	-	-	-	-	-	-	
	12.00	Pm	1.00	Am	Up	1	-	1	2	-	-	-	-	-	-	
					Down	1	-	2	3	-	-	-	-	-	-	
17/4/08	1.00	Am	2.00	Am	Up	-	-	2	2	-	-	-	-	-	-	
					Down	-	1	1	2	-	-	-	-	-	-	
	2.00	Am	3.00	Am	Up	2	1	1	4	-	-	-	-	-	-	
					Down	-	1	2	3	-	-	-	-	-	-	
	3.00	Am	4.00	Am	Up	2	2	2	6	-	2	-	-	-	2	
					Down	1	1	3	5	-	1	-	-	-	1	
	4.00	Am	5.00	Am	Up	3	2	2	7	-	-	-	-	-	-	
					Down	2	1	1	4	-	-	-	-	-	-	
	5.00	Am	6.00	Am	Up	4	2	4	10	-	-	-	-	-	-	
					Down	2	1	-	3	-	-	-	-	-	-	
	6.00	Am	7.00	Am	Up	6	3	5	14	-	2	-	-	-	2	
					Down	3	2	2	7	-	-	-	-	-	-	
	7.00	Am	8.00	Am	Up	12	4	8	24	-	1	-	-	-	1	
					Down	8	3	2	13	-	2	-	-	-	2	
	8.00	Am	9.00	Am	Up	10	4	9	23	-	-	-	-	-	-	
					Down	5	2	3	10	-	-	-	-	-	-	
	9.00	Am	10.00	Am	Up	4	3	5	12	-	-	-	-	-	-	
					Down	3	2	2	7	-	-	-	-	-	-	
	10.00	Am	11.00	Am	Up	6	4	3	13	-	-	-	-	-	-	
					Down	2	2	4	8	-	-	-	-	-	-	
	11.00	Am	12.00	Am	Up	8	3	5	16	-	2	-	-	-	2	
					Down	5	4	4	13	-	1	-	-	-	1	
	12.00	Am	1.00	Pm	Up	6	3	6	15	-	-	-	-	-	-	
					Down	3	3	5	11	-	-	-	-	-	-	
	1.00	Pm	2.00	Pm	Up	7	4	6	17	-	2	-	-	-	2	
					Down	4	2	4	10	-	2	-	-	-	2	
	2.00	Pm	3.00	Pm	Up	6	4	3	13	-	-	-	-	-	-	
					Down	3	4	6	13	-	-	-	-	-	-	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
	3.00	Pm	4.00	Pm	Up	5	3	2	10	-	-	-	-	-	-	
					Down	2	2	6	10	-	-	-	-	-	-	
	4.00	Pm	5.00	Pm	Up	6	3	2	11	-	-	-	-	-	-	
					Down	4	3	4	11	-	-	-	-	-	-	
	5.00	Pm	6.00	Pm	Up	6	4	2	12	-	-	-	-	-	-	
					Down	2	2	3	7	-	-	-	-	-	-	
	6.00	Pm	7.00	Pm	Up	7	2	2	11	-	-	-	-	-	-	
					Down	3	2	4	9	-	-	-	-	-	-	
	7.00	Pm	8.00	Pm	Up	4	3	3	10	-	-	-	-	-	-	
					Down	2	3	3	8	-	1	-	-	-	1	
	8.00	Pm	9.00	Pm	Up	4	2	2	8	-	1	-	-	-	1	
					Down	3	3	1	7	-	-	-	-	-	-	
	9.00	Pm	10.00	Pm	Up	3	2	2	7	-	-	-	-	-	-	
					Down	1	1	2	4	-	2	-	-	-	2	
	10.00	Pm	11.00	Pm	Up	2	2	-	4	-	-	-	-	-	-	
					Down	-	-	3	3	-	-	-	-	-	-	
	11.00	Pm	12.00	Pm	Up	-	-	-	-	-	-	-	-	-	-	
					Down	1	2	2	5	-	-	-	-	-	-	
	12.00	Pm	1.00	Am	Up	2	1	-	3	-	-	-	-	-	-	
					Down	-	2	1	3	-	-	-	-	-	-	
	1.00	Am	2.00	Am	Up	-	1	-	1	-	-	-	-	-	-	
					Down	-	-	-	-	-	-	-	-	-	-	
	2.00	Am	3.00	Am	Up	2	1	1	4	-	-	-	-	-	-	
					Down	1	1	-	2	-	-	-	-	-	-	
	3.00	Am	4.00	Am	Up	3	2	2	7	-	1	-	-	-	1	
					Down	2	1	-	3	-	-	-	-	-	-	
	4.00	Am	5.00	Am	Up	4	3	2	9	-	2	-	-	-	2	
					Down	2	2	1	5	-	1	-	-	-	1	
	5.00	Am	6.00	Am	Up	6	4	6	16	-	-	-	-	-	-	
					Down	2	2	1	5	-	-	-	-	-	-	
	6.00	Am	7.00	Am	Up	6	4	8	18	-	3	-	-	-	3	
					Down	4	3	2	9	-	-	-	-	-	-	
	7.00	Am	8.00	Am	Up	6	2	6	14	-	2	-	-	-	2	
					Down	3	1	2	6	-	-	-	-	-	-	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
	8.00	Am	9.00	Am	Up	5	3	3	11	-	-	-	-	-	-	
					Down	8	2	-	10	-	-	-	-	-	-	
	9.00	Am	10.00	Am	Up	2	2	4	8	-	-	-	-	-	-	
					Down	6	2	2	10	-	-	-	-	-	-	
	10.00	Am	11.00	Am	Up	2	1	2	5	-	1	-	-	-	1	
					Down	4	3	3	10	-	1	-	-	-	1	
	11.00	Am	12.00	Am	Up	5	2	-	7	-	-	-	-	-	-	
					Down	4	2	2	8	-	-	-	-	-	-	
18/4/08	12.00	Am	1.00	Pm	Up	5	3	1	9	-	-	-	-	-	-	
					Down	2	1	2	5	-	-	-	-	-	-	
	1.00	Pm	2.00	Pm	Up	5	2	3	10	-	-	-	-	-	-	
					Down	3	3	2	8	-	-	-	-	-	-	
	2.00	Pm	3.00	Pm	Up	4	2	3	9	-	-	-	-	-	-	
					Down	6	2	3	11	-	-	-	-	-	-	
	3.00	Pm	4.00	Pm	Up	2	2	2	6	-	1	-	-	-	1	
					Down	3	3	4	10	-	-	-	-	-	-	
	4.00	Pm	5.00	Pm	Up	6	4	5	15	-	-	-	-	-	-	
					Down	5	3	3	11	-	-	-	-	-	-	
	5.00	Pm	6.00	Pm	Up	7	3	2	12	-	-	-	-	-	-	
					Down	8	3	6	17	-	-	-	-	-	-	
	6.00	Pm	7.00	Pm	Up	4	2	3	9	-	1	-	-	-	1	
					Down	3	-	-	3	-	-	-	-	-	-	
	7.00	Pm	8.00	Pm	Up	5	-	-	5	-	-	-	-	-	-	
					Down	2	2	4	8	-	-	-	-	-	-	
	8.00	Pm	9.00	Pm	Up	3	1	-	4	-	-	-	-	-	-	
					Down	4	-	2	6	-	-	-	-	-	-	
	9.00	Pm	10.00	Pm	Up	2	-	1	3	-	-	-	-	-	-	
					Down	2	-	2	4	-	-	-	-	-	-	
	10.00	Pm	11.00	Pm	Up	3	-	-	3	-	-	-	-	-	-	
					Down	1	2	-	3	-	2	-	-	-	2	
	11.00	Pm	12.00	Pm	Up	-	1	-	1	-	-	-	-	-	-	
					Down	2	1	1	4	-	-	-	-	-	-	
	12.00	Pm	1.00	Am	Up	-	-	-	-	-	-	-	-	-	-	
					Down	-	1	1	2	-	-	-	-	-	-	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
	1.00	Am	2.00	Am	Up	-	-	-	-	-	-	-	-	-	-	
					Down	-	-	-	-	-	-	-	-	-	-	
	2.00	Am	3.00	Am	Up	2	1	-	3	-	1	-	-	-	1	
					Down	1	-	-	1	-	-	-	-	-	-	
	3.00	Am	4.00	Am	Up	2	2	1	5	-	-	-	-	-	-	
					Down	3	1	-	4	-	-	-	-	-	-	
	4.00	Am	5.00	Am	Up	4	2	2	8	-	-	-	-	-	-	
					Down	3	3	1	7	-	-	-	-	-	-	
	5.00	Am	6.00	Am	Up	6	4	2	12	-	-	-	-	-	-	
					Down	4	2	1	7	-	-	-	-	-	-	
	6.00	Am	7.00	Am	Up	8	4	6	18	-	-	-	-	-	-	
					Down	2	3	2	7	-	-	-	-	-	-	

TRAFFIC COUNT AT BHALUKPONG

Annexure -II

Dated & Month	Time Hour		Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From	To		Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)	2(b)	3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
16/4/08	2.00 Pm	3.00 Pm	Up	12	3	20	35	4	3	-	-	-	7	
			Down	3	-	10	13	-	6	3	-	-	9	
	3.00 Pm	4.00 Pm	Up	5	-	16	21	3	6	-	-	-	9	
			Down	18	-	36	54	-	4	2	-	-	6	
	4.00 Pm	5.00 Pm	Up	6	-	16	22	-	-	-	-	-	-	
			Down	11	-	20	31	1	46	-	-	-	47	
	5.00 Pm	6.00 Pm	Up	8	-	22	30	-	31	-	-	-	31	
			Down	9	-	23	32	3	13	-	-	-	16	
	6.00 Pm	7.00 Pm	Up	5	2	22	29	-	20	-	-	-	20	
			Down	3	2	21	26	2	11	1	-	-	14	
	7.00 Pm	8.00 Pm	Up	3	6	11	20	11	7	-	-	-	19	
			Down	6	-	22	28	4	22	-	-	-	26	
	8.00 Pm	9.00 Pm	Up	6	-	25	31	-	8	-			8	
			Down	-	-	12	12	-	16	-			16	
17/4/08	5.00 Am	6.00 Am	Up	-	-	17	17	-	22	-	-	-	22	
			Down	-	-	9	9	9	29	-	-	-	38	
	6.00 Am	7.00 Am	Up	10	2	22	34	8	6	-	-	-	14	
			Down	4	-	11	15	6	22	-	-	-	28	
	7.00 Am	8.00 Am	Up	12	-	20	32	9	8	-	-	-	17	
			Down	3	-	10	13	-	13	-	-	-	13	
	8.00 Am	9.00 Am	Up	7	4	28	39	4	3	-	-	-	7	
			Down	6	-	22	28	2	10	-	-	-	12	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
	9.00	Am	10.00	Am	Up	16	11	17	44	9	14	-	-	-	23	
					Down	11	9	20	40	5	9	-	-	-	14	
	10.00	Am	11.00	Am	Up	5	4	16	25	8	2	-	-	-	10	
					Down	3	-	12	15	2	-	-	-	-	2	
	11.00	Am	12.00	Pm	Up	2	-	19	21	2	-	-	-	-	2	
					Down	5	-	22	27	1	-	-	-	-	1	
	12.00	Pm	1.00	Pm	Up	5	-	32	37	-	3	-	-	-	3	
					Down	-	-	12	12	1	7	3	-	-	11	
	1.00	Pm	2.00	Pm	Up	13	-	18	31	2	-				2	
					Down	-	-	11	11	3	4				4	
	2.00	Pm	3.00	Pm	Up	12	-	17	29	3	9	-	-	-	9	
					Down	11	-	15	26	7	2	-	-	-	9	
	3.00	Pm	4.00	Pm	Up	3	-	58	61	6	7	-	-	-	13	
					Down	14	-	16	30	6	1	-	-	-	7	
	4.00	Pm	6.00	Pm	Up	7	4	24	35	3	44	-	-	-	47	
					Down	19	3	30	52	-	29	-	-	-	29	
	6.00	Pm	7.00	Pm	Up	-	3	20	23	-	12	-	-	-	12	
					Down	6	4	22	32	4	22	-	-	-	26	
	7.00	Pm	8.00	Pm	Up	-	-	20	20	11	11	-	-	-	22	
					Down	2	7	20	29	9	18	-	-	-	27	
	8.00	Pm	9.00	Pm	Up	7	-	19	26	-	6	-	-	-	6	
					Down	-	-	14	14	7	11	-	-	-	18	
	9.00	Pm	10.00	Pm	Up	-	-	20	20	-	7	-	-	-	7	
					Down	-		13	13	3	4	-			7	

Dated & Month	Time Hour				Journey up & down	LIGHT VEHICLE				HEAVY VEHICLE						Remarks
	From		To			Two wheeler	Three wheeler	Four wheeler (Car, Van, Taxi etc.)	Total Journey (4a) to (4c) (in nos.)	Bus, Omnibus etc.	Tata truck, Tanker etc.	Dozer, Escavator etc.	Roller, stone crusher etc.	Engine, Tram etc.	Total Journey (6a) to (6c) (in nos.)	
1	2(a)		2(b)		3	4(a)	4(b)	4(c)	5	6(a)	6(b)	6(c)	6(d)	6(e)	7	8
18/4/08	5.00	Am	6.00	Am	Up	4	-	22	26	-	17	-	-	-	17	
					Down	3	-	6	9	4	11	-	-	-	15	
	6.00	Am	7.00	Am	Up	11	-	24	35	7	7	-	-	-	14	
					Down	2	-	10	12	6	28	-	-	-	34	
	7.00	Am	8.00	Am	Up	17	3	15	32	6	7	2	-	-	13	
					Down	9	2	7	16	4	10	-	-	-	14	
	8.00	Am	9.00	Am	Up	9	4	28	37	9	2	-	-	-	11	
					Down	-	2	4	6	3	7	-	-	-	10	
	9.00	Am	10.00	Am	Up	8	6	32	40	6	18	-	-	-	24	
					Down	9	-	20	29	2	-	-	-	-	2	
	10.00	Am	11.00	Am	Up	15	3	18	33	4	5	-	-	-	9	
					Down	4	6	10	14	2	3	-	-	-	5	
	11.00	Am	12.00	Am	Up	4	-	20	24	2	4	-	-	-	6	
					Down	7	3	20	27	-	1	-	-	-	1	
	12.00	Am	1.00	Pm	Up	6	3	10	16	-	-	3	-	-	3	
					Down	7	2	11	18	18	-	-	-	-	18	
	1.00	Pm	2.00	Pm	Up	9	-	14	23	5	-	-	-	-	5	
					Down	3	4	10	13	7	2	-	-	-	9	