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## Traffic management plan for Port Blair city, India

Madhu Errampalli <sup>a\*</sup>, Ravinder Kayitha <sup>b</sup>

<sup>a</sup> Principal Scientist, Transportation Planning (TP) Division, CSIR-Central Road Research Institute (CRRI), Mathura Road,  
New Delhi - 110025, India

<sup>b</sup> Principal Scientist, Transportation Planning (TP) Division, CSIR-Central Road Research Institute (CRRI), Mathura Road,  
New Delhi - 110025, India

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### Abstract

The population of Port Blair has steadily grown at about 6.5% per annum but it fell down to 0.62% per annum in the last decade. However the population of vehicles has increased at an average of 12% per annum and road infrastructure has not been able to keep pace with the increasing vehicular growth. The mismatch between supply and demand of infrastructure apart from improper traffic regulation has culminated in increasing traffic related problems such as congestion, accidents, air pollution etc. in the city of Port Blair. Considering the above issues, the present study has been formulated with an objective to work out a traffic management plan to ease the existing traffic problems in Port Blair and to optimize the use of existing infrastructure focusing on short term remedial measures to improve traffic conditions. Based on conducted traffic studies namely traffic volume studies at Intersections and Mid-blocks, Pedestrians Studies, Parking Studies and Speed and Delay Studies, short term solutions are recommended which include geometric design of 28 identified junctions and design of traffic circulation plans at three locations in Port Blair city for smooth movement of traffic at the city center and market areas. Different traffic management schemes were also tested with microscopic simulation models using VISSIM 5.40 software. Further the recommendations are also proposed to widen the identified sections of the road network, restriction of commercial vehicle movements, design of parking facilities and pedestrian facilities along with traffic control devices namely signals, signages and markings.

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\* Corresponding author. Tel.: +91-11-2631 2268; fax: +91-11-26845943.  
E-mail address: [errampalli.madhu@gmail.com](mailto:errampalli.madhu@gmail.com)

## 1. Introduction

Port Blair is the capital city of Andaman & Nicobar Islands, India and its population has steadily increased from 14,075 in 1961 to 99,984 in 2001 with an average annual growth rate of 6.5%. As per the Census (2011), the population of Port Blair is 100,608 in 2011 which has increased with very insignificant average annual growth of 0.62%. Though the resident population has not shown significant growth, the visitor population of 136,426 in 2008 is becoming significant in Port Blair which is more than the resident population (APWD, 2010). As the economic development activities growing, transportation needs have increased, accordingly number of vehicles have grown. With the recent advancements in vehicle manufacturing technology and economic growth of the country, led to rapid increase in the vehicle population. In Andaman & Nicobar Islands, it has gone up from less than 10,000 in 1991 to around 65,000 in 2010. Though the population has increased with only 0.62% per annum, the vehicles have increased at an average of 12% per annum (APWD, 2010). Presently vehicle population growth rate is increasing exponentially with an annual growth rate of around 13% and is expected to reach 120 thousands by 2015. However the road infrastructure has not been able to keep pace with the increasing vehicular growth. At present Port Blair has about 117 km of road length (majority of traffic ply only on 50% of roads) of varying widths of roads which is of very little in terms of supply considering the demand. The major economic base of Port Blair is tourism industry in addition to the Sea based industries. The in-state vehicles and tourist movement put a burden on the existing inadequate road infrastructure. This mismatch between supply and demand of infrastructure has culminated in increasing traffic related problems such as congestion, accidents, air pollution etc. The commercial activities are located in the old city area around Goal Ghar, Janglighthat and also at the city centre near to Gandhi Statue covering Bus Terminal area having direct access to and from major roads which has on-street parking blocking half of the carriageways. In the absence of sidewalks and crossing facilities, pedestrians are also forced to share the carriageways along with the vehicles and thus are exposed to safety hazards and also interfere with the free movement of vehicles. Improper traffic regulation, ill-designed intersections and inadequate road infrastructure are causing immense traffic problems, which needs immediate attention in improving the traffic situation.

Considering the above issues, the present study is formulated with an objective to work out a traffic management plan to ease the existing traffic problems in Port Blair and to optimize the use of existing infrastructure focusing on short term remedial measures to improve traffic conditions considering junctions improvement, area traffic management schemes, parking plans etc. For this purpose, various traffic studies namely traffic volume studies at Intersections and Mid-blocks, Pedestrians Studies, Parking Studies and Speed and Delay Studies are conducted and based on these studies, short term solutions are recommended which include geometric design of 28 identified junctions and design of traffic circulation plans for smooth movement of traffic at the city center and market areas. These traffic management schemes were also tested with the microscopic simulation models developed in VISSIM 5.40 software environment. Further the recommendations are also proposed to widen the identified sections of the road network, restriction of commercial vehicle movements, design of parking facilities and pedestrian facilities along with traffic control devices namely signals, signages etc.

The present paper is organized as follows: Introduction about the city of Port Blair with description of traffic problems and objectives of the present study is described in Section 1. The methodology adopted in the study is presented in Section 2. The traffic studies and results for them are discussed in Section 3. Whereas Section 4 gives the developed short term remedial measures to improve traffic conditions considering junctions improvement, area traffic management schemes etc. The development of microscopic simulation model to evaluate various traffic circulation plans is also discussed in this section. Finally, the concluding remarks are given in Section 5.

## 2. Methodology

To achieve the objective mentioned in previous chapter, the methodology for this study has been devised and presented in the form of flow chart as shown in Fig. 1. As can be seen from the Fig. 1, a reconnaissance survey was made to understand the existing road network and related traffic problems at the first instance. In addition to that, discussions were also made with the concerned officials to get the various inputs before proceeding for data collection. Then, the study methodology has been devised in terms of conducting various traffic studies. The data analysis is

followed from the various traffic and transportation studies to estimate vehicular traffic, pedestrian and parking demand. These results have been utilized in developing short term solutions.

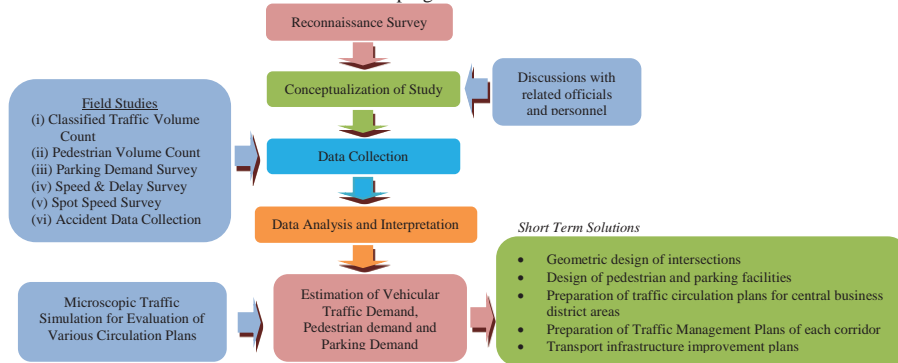


Fig. 1. Devised Methodology for the Present Study.

### 3. Traffic Studies

#### 3.1. Classified Traffic Volume Counts at Mid-blocks and Intersections

Classified traffic volume count survey is conducted at 14 intersections and 6 mid-block locations. These studies conducted for 14 hours (from 6:00 AM to 8:00 PM) for certain locations and 24 hours (from 8:00 AM to 8:00 AM) for certain locations in order to understand the pattern of traffic movement along the highways/ major arterials during the night hours as well. The typical hourly variation of traffic volume and traffic composition for Goal Ghar Junction and Janglighthat Road are presented in Fig. 2 and 3. The summary of all 14 intersections and 6 mid-blocks are presented in Table 1 and 2 respectively.

From the Fig. 2 and Table 1, it can be observed that traffic volume of about 32,000 and 40,000 for 24-hour at Bathu Basti and Hayat Singh Junctions respectively. At the other junctions, it is varying from about 4,000 (at Corbin Junction) to 53,000 (Goal Ghar Junction) for 14-hour duration. The maximum peak hour flow of about 3,500 Passenger Car Units (PCU)/hr at Goal Ghar Junction and minimum peak hour flow of about 350 PCU/hr at Corbin Junction can be observed. The maximum traffic can be observed during evening at 18:00 Hrs at Goal Ghar Junction. The junctions surrounding to Clock Tower Junction namely Model School, Bengali Club, Light House and Goal Ghar Junctions have also recorded more than 40,000 vehicles/14-hour due to shopping and other commercial activities. The fast moving vehicles (FMV) are observed to be 99% of total traffic and slow moving vehicle (SMV) has very insignificant and negligible. The two wheeler composition is very high and it is varying from about 40 to 55% followed by car of about 15 to 30% at different intersections. Auto rickshaws composition is also varying from 10 to 40% across different intersections. The commercial vehicles include Light Commercial Trucks (LT), Two Axle Heavy Trucks (HT) and Multi Axle Trucks (MT) have the composition about 1 to 13%. Bus has a maximum of 5% can be observed. From the Fig. 3 and Table 2, it can be observed that traffic volume on mid-blocks is varying from about 4,000 (Corbin Road) to 31,000 (Janglighthat Road) for 14-hour duration. The maximum peak hour flow of about 2,200 PCU/hr on School Line and Janglighthat Road and minimum peak hour flow of about 500 PCU/hr at Corbin Road can be observed. The shopping and other commercial activities are located around Janglighthat Road, the maximum traffic can be observed during evening at 18:00 Hrs. The two wheeler composition is varying from 40 to 55% followed by car of about 15 to 30%. Auto rickshaws and commercial vehicles composition is also varying from 10 to 40% and 3 to 18% respectively. Bus has a maximum of 11% can be observed.

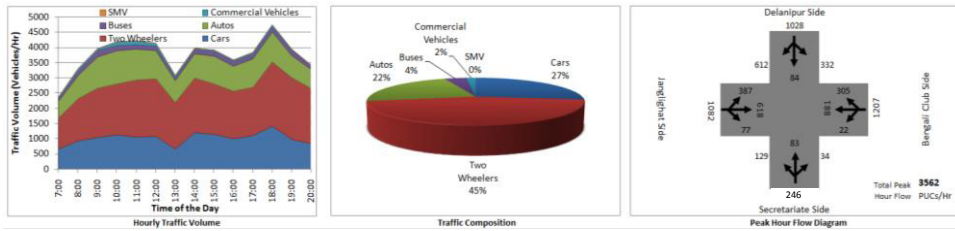


Fig. 2. Typical Hourly Traffic Variation, Composition and Peak Hour Flow Diagram at Goal Ghar Junction.

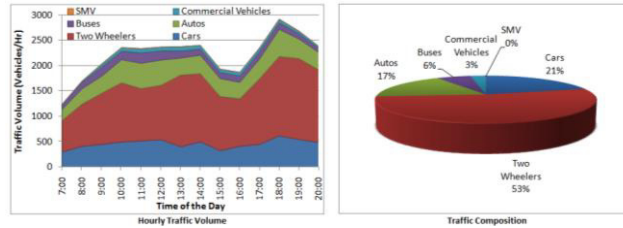


Fig. 3. Typical Hourly Traffic Variation and Traffic Composition on Janglightat Road.

Table 1. Summary of Classified Traffic Volume at Different Junctions.

S. No.	Junction Name	Time Duration	Small Car (CS)*	Big Car (CB)**	Auto (A)	Bus (B)	Mini Bus (MB)	Two Wheelers (TW)	LT	HT	MT	Bi-cycle (CYC)	CY-SMV	Total FMV	Total SMV	Grand Total Vehicles	Grand Total PCU	Peak Hour Flow	Peak Hour
1	Chatham	14Hrs	1632	738	2345	322	258	7098	178	485	16	6	0	13072	6	13078	10244	941	09:00
2	Light House	14Hrs	9797	3421	9182	894	878	17037	404	1339	13	14	3	42965	17	42982	35024	3327	12:00
3	Delanipur	14Hrs	4540	2296	8105	297	191	17095	420	349	17	9	1	33310	10	33320	22377	2161	12:00
4	Goal Ghar	14Hrs	9750	4552	11856	1533	567	23690	488	291	102	11	0	52829	11	52840	39596	3561	18:00
5	Hayat Singh	24Hrs	7222	4679	5421	1062	327	20076	398	661	30	39	3	39876	42	39918	31071	2429	19:00
6	Dairy Farm	14Hrs	5007	3516	4690	992	271	16610	714	826	3	42	0	32629	42	32671	26142	2395	10:00
7	Bathu Basti	24Hrs	4024	1812	4732	818	163	18498	737	896	19	44	4	31699	48	31747	24064	2227	09:00
8	Clock Tower	14Hrs	5973	2481	21876	706	252	21774	143	131	16	26	3	53352	29	53381	33478	4887	19:00
9	Model School	14Hrs	10495	2347	14831	648	429	17567	662	460	2	17	0	47441	17	47458	34024	3134	10:00
10	IP&T	14Hrs	7202	4067	4878	53	36	17313	139	143	3	0	0	33834	0	33834	23233	2451	12:00
11	Bengali Club	14Hrs	9851	4483	13230	1097	353	20112	360	295	7	29	1	49788	30	49818	36301	3195	14:00
12	Hawa Ghar	14Hrs	3722	1468	4535	138	36	10433	251	240	14	1	1	20837	2	20839	14308	1326	18:00
13	Corbin	14Hrs	495	308	432	59	17	2055	187	307	25	3	2	3885	5	3890	3572	334	17:00
14	Prothrapur	14Hrs	2722	1248	3519	337	36	7320	397	947	33	19	0	16559	19	16578	14052	1303	18:00

Note: \*Engine capacity less than 1400 cc; \*\* Engine capacity more than 1400 cc; LT-Light Commercial Trucks; HT-Two Asle Trucks; MT-Multi Asle Trucks; CY-SMV-Cycle Rickshaws and Other-SMV

Table 2. Summary of Classified Traffic Volume at Different Junctions.

S. No.	Mid-Block Name	Time Duration	Small Car (CS)*	Big Car (CB)**	Auto (A)	Bus (B)	Mini Bus (MB)	Two Wheelers (TW)	LT	HT	MT	Bi-cycle (CYC)	CY-SMV	Total FMV	Total SMV	Grand Total Vehicles	Grand Total PCU	Peak Hour Flow	Peak Hour
1	School Line Road	14Hrs	3834	1743	1629	915	301	10451	253	475	909	63	0	20510	63	20573	20743	2180	17:00
2	Carbin Road	14Hrs	607	386	791	72	32	1488	225	311	14	47	0	3926	47	3973	3757	472	11:00
3	Gandhi Statue - Marine Gate Road	14Hrs	665	427	1761	649	124	2958	554	175	3	15	2	7316	17	7333	6969	671	12:00
4	Power House - Marine Gate Road	14Hrs	2192	1447	2192	545	88	3534	146	148	2	5	0	10294	5	10299	8948	804	19:00
5	Hadoo - Dhanavatri Road	14Hrs	1448	803	3889	469	340	6607	143	212	1	9	0	13912	9	13921	10279	961	09:00
6	Janglightat Road	14Hrs	3886	2599	5436	1555	354	16373	502	306	18	21	0	31029	21	31050	24352	2144	18:00

Note: \*Engine capacity less than 1400 cc; \*\* Engine capacity more than 1400 cc; LT-Light Commercial Trucks; HT-Two Asle Trucks; MT-Multi Asle Trucks; CY-SMV-Cycle Rickshaws and Other-SMV

The major road network has been digitized in order to demonstrate the traffic loads on the network. The road network of total 113 links with 93 nodes is created using the NetDisplay 2.0 (Network Display Program developed at CRR). The daily traffic volumes at observed links have been extended to other adjacent links appropriately in order to load the network with traffic loads. After analyzing the daily and peak hour traffic loads on the road network for base year condition, the traffic loads for the arterial road network of Port Blair city have been appropriately projected for the year 2016 and 2021. The observed traffic loads along with projected traffic loads are shown in Fig. 4. From the Fig. 4, it can be observed that the links near Clock Tower, Bengali Club, Goal Ghar, Delanipur, Bathu Basti and Hayat Singh Junction areas are going to be heavily congested. Hence, the situation once again highlights that they need immediate attention to improve the traffic situation.



Fig. 4: Daily Traffic Loads on Arterial Road Network of Port Blair for Base and Future Years (2016 and 2021).

3.2. Pedestrian Studies

For a safe and free movement of pedestrians there is an imminent need to study the pedestrian needs and accordingly plan appropriate facilities for their safe movement along and across the carriageways. For this purpose, Pedestrian Volume Counts are conducted at 26 locations in tandem with the traffic volume counts. Typical hourly variation of pedestrian count at Clock Tower and Gandhi Statue is shown in Fig. 5. The analysis of pedestrian volume count at all 26 locations reveal that Clock Tower, Model School, Janglighat and Gandhi Statue areas have peak hour pedestrian volumes as high as 1500 pedestrians/hr which is warranting for appropriate pedestrian facilities.

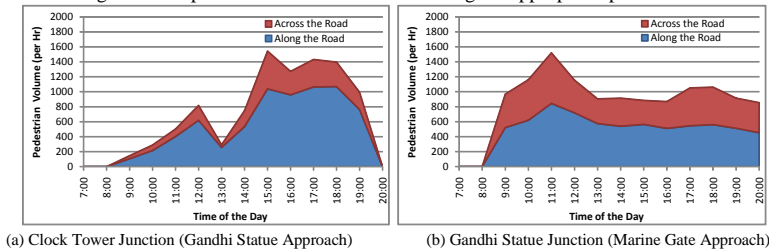


Fig. 5: Typical Hourly Variation of Pedestrian Volume at Different Locations.

3.3. Parking Studies

There are commercial activities spread over the city and these areas with shops having direct access to the road with little space left for providing formal parking lot. This has resulted in the usage of available road space for on-street parking by encroaching the carriageway. Of late, the parking situation has worsened and has left people with no

choice other than to park on roads. Presently, the ill organized parking in the commercial centre is on the increase and needs to be regulated and supplemented with additional off-street parking facilities. For this purpose, the appropriate parking studies are conducted at 17 selected locations in the city center and commercial places to assess the parking demand and based on the same, remedial measures are suggested appropriately. The typical hourly variation of accumulation and duration of parking at Dolly Ganj - Bathu Basti Junction are presented in Fig. 6. From the parking duration analysis, it can be observed that most of the parkers are parking for short duration between 1 and 3 hours which may lead to congestion of roads. It can be recommended from the analysis that the multi- storey parking facilities at Gandhi Statue area and Off-street parking facilities at Janglighthat are warranted. The parking facilities near Y Narayan Junction can also be considered. In addition to above, Haddo to Delanipur Junction suitable on-street parking space shall be developed so as to avoid obstruction to main carriageway traffic.

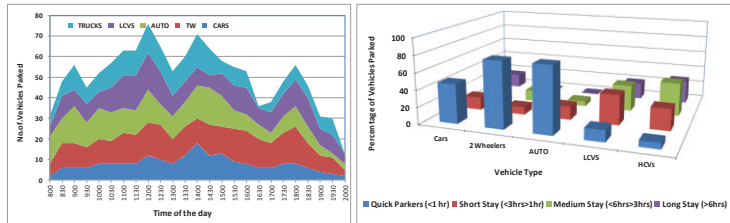


Fig. 6: Hourly Variation of Accumulation and Duration of Parking at Dolly Ganj - Bathu Basti Junction.

3.4. Spot Speed and Speed & Delay Studies

On the basis of reconnaissance of the road sections, it was noted that major portion of the roads are frequented with cross roads and roadside developments causing delays and congestion. Considering this, speed and delay study has been conducted at 5 road stretches (a total of 44.2 Km length) covering most of the arterial road network of Port Blair. Probe Vehicle method has been used for this study and conducted in different times of the day to account for the peak and non-peak hour traffic separately. The summary of the speed and delay results are presented in Table 3. From the Table 3, it can be observed that the average journey speeds are ranging from 25 to 35 kmph. The delays are about a maximum of 25% of journey time can be observed at Delanipur and Hayat Singh Junction Stretch. Apart from this, spot speed studies on Airport Road at two locations are also conducted in order to assess the operating characteristics of the road and associated road safety on selected sections. The collected spot speed data has been analyzed and calculated the average spot speeds and presented in Table 4. From the Table 4, it can be observed that speed of cars is ranging from 40 to 45 kmph followed by two wheelers and auto rickshaws in a range of 35 to 40 kmph. It is also observed that commercial heavy vehicles are also plying as same as cars and two wheelers which is making the present situation more unsafe. This situation needs immediate attention in terms of restricting speed by installing appropriate speed limit signs and other traffic control devices to enhance the safety.

4. Traffic Management Measures

4.1. Geometric Design of Intersections

As discussed in the previous section, the traffic volume, speed, pedestrian and parking studies have been conducted at different intersections and mid block sections in order to assess the traffic situation. It was inferred from the results of these studies, 28 intersections need immediate attention for geometric redesign improvement which requires scientific analysis of traffic operations and designs based on traffic engineering principles. The selected junctions are: 1) Chatham, 2) Haddo, 3) Old Dhanavatri, 4) Delanipur, 5) Goal Ghar, 6) Mini Bay, 7) Bathu Basti, 8) Prothrapur, 9) Carbin, 10) Hawa Ghar, 11) Y Narayan, 12) Power House, 13) Marine Gate, 14) RBV, 15) Secretariat, 16) Hayat Singh, 17) Dairy Farm, 18) Old CCS Road, 19) Dairy Farm Basti, 20) Clock Tower, 21) Gandhi Statue, 22) Light House, 23) IP&T, 24) Bengali Club, 25) Fire Station, 26) Annapurna, 27) CAT and 28) Model School. The conceptual

drawings have been prepared using the satellite images of these junctions and typical conceptual geometric design for Bengali Club Junction is shown in Fig. 7.

Table 3: Summary of Speed and Delay Results on Different Stretches of Arterial Road Network of Port Blair.

Stretch No.	Direction	Length (Km)	Run No.	Travel Time (mm:ss)	Speed (Kmph)	Delay (mm:ss)	% age Dealy
I (a)	Chatham Jetty – Bathu Basti (Via Dairy Farm)	9.9	1	19:51.98	29.5	0:00.00	0%
			2	18:44.18	32.2	0:25.18	2%
			3	20:59.27	27.8	0:44.92	4%
I (b)	Bathu Basti – Chatham Jetty (Via Dairy Farm)	10.0	1	22:04.02	27.5	0:02.05	0%
			2	18:22.24	33.5	0:02.50	0%
			3	20:15.62	29.6	0:19.33	2%
II (a)	Chatham Jn – Bathu Basti (Via Carbin Jn.)	12.6	1	24:34.46	29.6	1:10.53	5%
			2	24:51.21	30.0	0:15.27	1%
II (b)	Bathu Basti – Chatham Jn (Via Carbin Jn.)	12.6	1	21:42.55	34.1	0:18.16	1%
			2	26:01.99	28.4	0:46.69	3%
III (a)	Gandhi Statue Jn – Carbin Jn. (Via Carbin Beach)	11.0	1	22:44.86	29.8	0:21.81	2%
			2	21:35.36	31.2	0:37.47	3%
III (b)	Gandhi Statue Jn – Carbin Jn. (Via Carbin Beach)	11.0	1	21:01.17	32.0	0:00.00	0%
			2	22:13.20	31.8	0:00.00	0%
IV (a)	Delanipur Jn – Hayat Singh Jn (Via Pant Hospital)	6.2	1	14:55.56	25.5	3:48.04	25%
			2	15:04.92	29.1	2:14.7	15%
			3	10:47.75	32.2	0:18.02	3%
			4	10:47.75	32.2	0:18.02	3%
			5	13:09.18	28.0	1:00.15	8%
IV (b)	Hayat Singh Jn – Delanipur Jn (Via Pant Hospital)	6.2	1	13:25.09	34.3	1:09.78	9%
			2	12:37.80	30.5	0:28.37	4%
			3	15:14.00	27.2	1:41.54	11%
			4	11:39.92	33.9	0:10.97	2%
			5	12:14.55	31.7	0:32.95	4%
V	Goal Ghar Jn – Goal Ghar Jn (Via Bengali Club)	4.5	1	10:45.80	25.3	1:15.6	12%
			2	10:47.40	25.4	1:10.11	11%
			3	10:59.55	26.4	2:04.54	19%

Note: kmph-Kilometers per hour; mm:ss represents minutes and seconds

Table 4: Spot Speed Survey Results on Airport Road.

S. No	Location	Direction	Average Spot Speed (kmph)					
			Car	Two Wheeler	Auto	Bus	LT	HT
1	School Lines	Dairy Farm - School Line	40.5 (131)	37.3 (152)	36.5 (59)	36.8 (32)	40.4 (12)	36.0 (40)
2		School Line - Dairy Farm	42.4 (267)	40.0 (431)	41.3 (116)	39.6 (48)	43.7 (30)	38.9 (37)
3	Mini Bay	Mini Bay - Dolly Ganj	40.1 (51)	38.6 (114)	39.2 (26)	35.4 (12)	34.8 (11)	43.2 (11)
4		Dolly Ganj - Mini Bay	46.2 (62)	37.5 (113)	33.9 (26)	40.0 (6)	38.8 (5)	36.5 (13)

Note: kmph-Kilometers per hour; Values given in parenthesis represents sample size

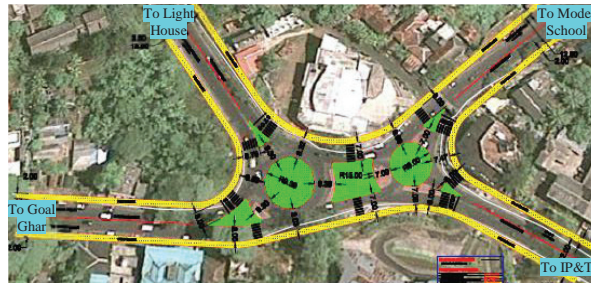


Fig. 7: Proposed Geometric Design Improvements for Bengali Club Junction



#### 4.2. Traffic Circulation Plans (TCP) through Microscopic Traffic Simulation

As can be seen from the traffic volume study results, peak hour traffic volumes at some of the intersections near central business district (CBD) and other commercial area is at their capacity thus leading to congestion and delays. The geometric design of the intersections in isolation alone will not yield good results in improving traffic conditions and they have to be coupled with appropriate traffic circulation plans. The circulation plans mainly deal with the restriction of movements and vehicles in that area in order to increase the efficiency of the traffic movement in that area. For this purpose, the areas around Clock Tower, Dairy Farm Junction - Hayat Singh Junction and Janglighthat are selected for implementing traffic circulation plans. Around Clock Tower area, a total of 9 intersections which include Light House, Gandhi Statue, Clock Tower, Annapurna Hotel, Model School, Fire Station, CAT Office, IP&T and Bengali Club Junctions are considered. Considering the prevailing traffic conditions, it was felt appropriate to propose the circulation plans and be evaluated with microscopic traffic simulation technique. For this purpose, VISSIM 5.40 (PTV, 2012) Software has been utilised to simulate the vehicular movements for five hours (i.e. 7:00 AM to 12:00 Noon) which include morning peak hour. To develop simulation model, the following steps are carried out:

(i) *Creation of Road Network and Driving behaviour*: Considered all 9 junctions with minor roads, the road network around Clock Tower area of Port Blair city is created in VISSIM. The driving behaviour based on Indian normal and aggressive behaviour is considered in VISSIM.

(ii) *Routing decisions and turning ratios at intersections*: Routing decisions for all the junctions are given on the basis of traffic survey results. These decisions are basically the ratios in which vehicles turn in different possible directions. For each hour different ratios are given for surveyed intersections.

(iii) *Traffic volume data*: In the selected network of Clock Tower area of Port Blair City, vehicle input in terms of hourly volume and vehicle composition has been given at 9 links. Vehicle composition defines the ratios of different types of vehicle in the given volume. The types of vehicles considered in this study are - car, two wheeler, auto, bus, mini bus and trucks (LT, HT and MT). For each time period, different vehicle composition has been given as input in VISSIM which are based on traffic survey results discussed in Section 3.1.

(iv) *Implementation of signals*: Mostly, the traffic is manually controlled by traffic police in Port Blair city. As Gandhi Statue junction, Bengali Club junction and Clock Tower junctions are rotaries, there is no signal or manual control at these junctions. In order to simulate such manual control at the intersections, fixed time control signal (cycle time of 90 to 120 sec assumed depending upon the traffic volume of intersection) is considered with green time calculated using traffic volume entering into intersection through that approach road.

(v) *Calibration and validation of model*: Calibration and validation procedure is carried out in VISSIM to simulate observed conditions of the vehicular movements in Port Blair city road network. To achieve validation in range of permissible error (considered as 20% in the present study) between observed and simulated data, various trials are done by appropriately changing the assumptions and parameter values in the VISSIM. In order to validate the developed simulation network, the observed travel speeds of cars on eight sections are utilised as an evaluation parameter. From the comparison of these results, it can be inferred that the error is ranging from 3 to 20% which is considered to be acceptable in the present study. From this, it can be concluded that the developed simulation model is able to predict the vehicular movements with reasonable degree of accuracy.

(vi) *Evaluation of various circulation plans around Clock Tower Area*: After validating model with reasonable accuracy, various circulation plans are simulated and evaluated using the developed simulation model in VISSIM. Evaluation is again based on total network travel time and delay data. Various options of traffic circulation plans (TCP) by eliminating signals at the intersections are proposed and considered in this study especially at Model School Junction as maximum delays occur in this entire CBD area. In the present study, various TCPs around Clock Tower area are simulated as given below:

- TCP 1: One way Circle- One way from Bengali Club Junction to Model School Junction and CAT Junction to IP&T Junction; both Clockwise (CW) and Anti-clockwise (ACW) directions.
- TCP 2: One way Main Circle- One way flow of traffic among Light House, Bengali Club, Model School, Clock Tower and Gandhi Statue junctions; both CW and ACW directions.
- TCP 3: Model School Turn (Clock Tower to Bengali Club) not allowed.
- TCP 4: Model School - CAT - Fire Station as Roundabout; both CW and ACW directions.



- TCP 5: Model School - CAT road one way.
- TCP 6: Gandhi Statue to Clock Tower road closed for vehicles.
- TCP 7: A circulation plan based on combination of TCP 1, 2 and 4.
- TCP 8: A circulation plan based on combination of TCP 2 and 4.

The results in terms of total travel time and delay in hours are obtained from simulation for all these options are estimated and shown in Fig. 8. From the Fig. 8, it can be clearly seen that TCP 7 and 8 are very favourable and best for improvement. Though TCP 7 and TCP 8 have similar values, TCP 8 is more favourable in terms of the feasibility and implementation. Since the Bus Station is located near Gandhi Statue Junction, Buses going to G B Pant Hospital can go via Clock Tower Junction - Y Narayan Junction and Buses going to Goal Ghar can go via Clock Tower Junction - Y Narayan Junction - Girls School - Fire Station Junction - CAT Office Junction - IP&T Junction - Bengali Club Junction. Buses going to Delanipur can go on the same route as given above and via Light House. In the same manner, Buses can come from Delanipur can go to Bus Station via Light House Junction - Power House Junction - Marine Gate Junction.

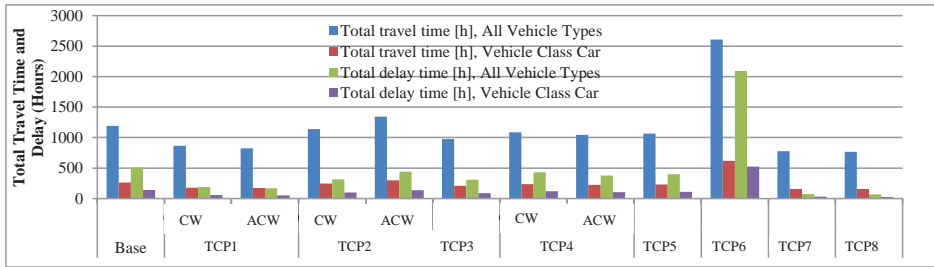


Fig. 8: Comparison of Travel Time and Delay Time of different Traffic Circulation Plans (TCP).

The recommended traffic circulation plan in clockwise traffic movement around Dairy Farm, Hayat Singh and Old CCN Road Junctions is shown in Figure 9(a). In order to ease congestion around Janglighthat area, the circulation plan in clockwise movement is recommended considering Junctions of Janglighthat School, Janglighthat Jetty and Fish Market Road as shown in Figure 9(b).

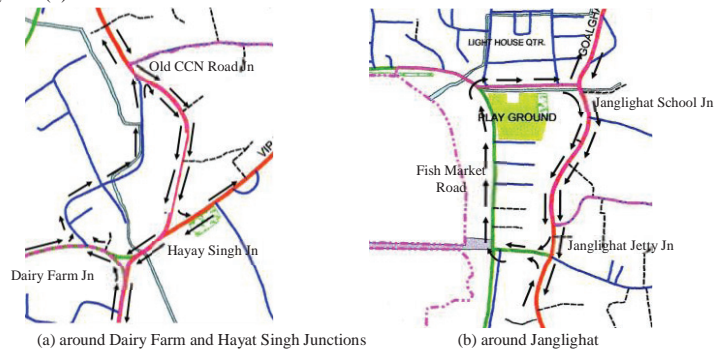


Fig. 9: Traffic Circulation Plan for the Area around Dairy Farm Junction and Janglighthat.

## 5. Concluding Remarks and Recommendations

In order to ease the existing traffic problems in the city of Port Blair and to optimize the use of existing infrastructure, short term remedial measures in terms of traffic management plans to improve traffic conditions are proposed. For this purpose, traffic studies namely traffic volume studies at Intersections and Mid-blocks, Pedestrians Studies, Parking Studies and Speed and Delay Studies are conducted. Based on these studies short term solutions are recommended which include:

- Geometric design of 28 identified junctions
- Design of traffic circulation plans at three locations for smooth movement of traffic at CBD and market areas
- Widening of existing roads and junctions along with addition of new links
- Pedestrian flows are significant at namely Light House, Model School, Clock Tower, Gandhi Statue and Bengali Club. At Goal Ghar Junction, Junglighat, Prem Nagar, Lillyganj and Bathu Basti also the pedestrian movements are quite high because of the land use characteristics. In view of these, following measures are recommended:
  - *At these junctions, encroachments shall be totally removed and clear passage in terms of continuous foot paths for pedestrian around the intersection shall be developed.*
  - *The foot over bridges (FOB) at different locations namely at Janglighat area near the Janglighat Jetty Junction and Model School Junction for all the arms, Clock Tower, Gandhi Statue, Dairy Farm (Airport approach) and between Dairy Farm and Hayat Singh can be considered.*
  - *Pelican Signal at Model School and Nirjala School is recommended especially to operate in school hours.*
- Parking Facilities are recommended to deal with parking problems as they are very severe and deteriorating the traffic conditions in terms of congestion and safety issues
  - *Since the road space is not available for parking, off-street parking can be developed at the appropriate locations such as IP&T Jn. Janglighat area, Janglighat Fisheries Market Road Bathu Basti Junction etc.*
  - *Multi-storey parking facilities are recommended near clock tower area and bus station to cater the parking needs of the traffic which are heading to entire area covered with in Light House Junction - Gandhi Statue Junction - Clock Tower Junction - Model School Junction - Bengali Club Junction.*
- Commercial vehicle movement restrictions between Chatham Jetty and Bathu Basti in day time by diversion of these vehicles via Carbin Scope Beach Road are recommended to manage traffic congestion within city area.
- Traffic Signals like Fixed time signals with channelisers are proposed at Delanipur Junction, Goal Ghar Junction, Bathu Basti Junction etc. as peak hour traffic flow is high.
- Traffic Signages in terms of Overhead Gantry Signs (Directions), Informatory Signs (Place Names, Directions, Facility information etc.), Warning Signs (Curves, Pedestrian Crossing, School Ahead etc.) and Regulatory Signs (Speed Limits, Parking restrictions, one way etc.) as per the IRC:67-2012 code are recommended to be installed at the appropriate places on the major corridor so that the road user gets the right information at right time.

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