PART: I - SURVEY REPORT INCLUDING FEASIBILITY STUDY
Feasibility Study (Series 3 of 4)

TRAFFIC IMPACT ASSESSMENT (TIA)




Submitted To

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EXECUTIVE SUMMARY

Recreation or tourist activities and infrastructure development both generate extra traffic on the adjoining road networks system that requires an improvement to the existing road conditions. Traffic Impact Assessment (TIA) study is generally required to support the transportation aspects of a proposed development. TIA is also necessary for authorities to take proper decision on the proposed project.

This report shows the details of the traffic impact study conducted for the Cable Car project which associated with the Naf Tourism Park at Teknaf in Cox's Bazar. The report contains six chapters. Chapter 1 described the background of the study, the project site and the objectives of the study. Conceptual Framework, survey design, traffic survey locations, willing to pay survey location, data collection and analysis methodology, various survey methodologies in the study area are discussed in chapter 2. Chapter 3 described existing transportation infrastructures and facilities of the study area. Chapter 4 discusses traffic data analysis, the future volume of traffic analysis, pedestrian level of services analysis and willing to pay analysis in three-point of the study area. Chapter 5 summarizes the results and recommendations regarding the approval of the proposed project.

Three main roads were studied in the study area. Three-wheeler (Auto Rickshaw and CNG) are the most dominating vehicles in the study area and it contains 55% of all vehicles. Overall public transports facilities in the study area need to improve. The analysis expressed that level of services accomplishes a category in New Marine Drive road and Old Marine Drive road (LGED road). Old Marine Drive road doesn't have sufficient carriageway width; however, the volume of traffic is low in this road. Hence, the level of services accomplishes a category. When the Cable Car Project will start to provide its service then the traffic volume will increase more in this road. The average level of services in Teknaf Cox's Bazar road is B. Its volume will increase more after completion of Cable car project. Average Annual Daily Traffic (AADT) volume is high in Teknaf Cox's Bazar road. Results express that 43.72% trips distributed in Teknaf town area. The average free-flow speed is 40km/hr in New Marine Drive road. The average delay in Teknaf-Cox's Bazar road is 2 hr. Pedestrian flow rate is low at every morning and night. During office hour time pedestrian flow rate is medium range. Future traffic forecast shows that capacity of the roads less than volume for the next 10 years of all roads according to the present study. The major problem is that was collected during Covid-19 situations, maybe the reason for less volume of present traffic.

Willing to pay survey emancipates that only 18% of people in the locality are tourist, however, 93.71% of people want the park in the locality because it will improve their living standard. As

per the respondent's opinion, the existing road is in poor condition (53.71%), the footpath is also the poor condition (71.14%), and the most important factor for the Naf Tourism Park is transit facilities which are in poor condition (56.86%). However, the existing town has only a bus terminal which is in poor condition. The existing roads have no capacity to meet future traffic demand (2050 traffic volume). It is hard to find parking facilities in the town which is the main challenge for the Naf Tourism Park.

Finally, from the rigorous analyses it can be summarized that it is not possible to accommodate the proposed change in land use without the implementation of mitigation measures. Hence, it is important to take necessary improvement plan i.e., development of new extended road network, improving the footpath conditions, and developing the transit facilities (parking facilities). Despite these limitations, it can strongly be concluded that these projects will contribute significantly to attract the tourists, and eventually, overall economic development process will accelerated.

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LIST OF ABBREVIATIONS OF TECHNICAL SYMBOLS AND TERMS

O-D	Origin-Destination
ADT	Average Daily Traffic
AADT	Average Annual Daily Traffic
HEF	Hourly Expansion Factor
DEF	Daily Expansion Factor
MEF	Monthly Expansion Factor
NMV	Non -Motorized Vehicle
HCM	Highway Capacity Manual
LOS	Level of Service
GDP	Gross Domestic Products
BDT	Bangladesh Taka
PCU	Passenger Car Unit
PCE	Passenger Car Equivalent
v/c	Volume- Capacity ratio
bn	Billion
WTTC	World Travel and Tourism Council
TIA	Traffic Impact Assesment
FFC	Flow Fluctuation Curve
WTP	Willing to Pay

CHAPTER 01: INTRODUCTION

Tourism is one of the top five export categories for as many as 83 percent of countries and is the main source of foreign exchange earnings at least 38 percent of countries [1]. Many developed countries like USA, UK, Italy, and France are ruling the industry. But the scenario of many Asian countries like India, Srilanka, Singapore, Maldives, Thailand, Malaysia, and Nepal shows that tourists are attracted to the climate, nature, and overall beauty of these spots. Although Bangladesh is in its early step according to WTTC (World Travel and Tourism Council) the direct contribution of Travel & Tourism to GDP was BDT 296.6bn (1.9% of total GDP) in 2014 and to rise by 6.1%, from 2015-2025 to BDT 566.3bn (2.0% of total GDP) in 2025 [1]. Bangladesh has many opportunities in the tourism sector and several areas in this country are now worldwide tourist attraction like Cox's Bazar, Sundarban, etc. Apart from that to meet the future demand of tourism places like Teknaf can be the hotspot for tourists because the world's largest Marin Drive mostly exists in Teknaf and St. Martin's Island [2].

1.1 Background

Teknaf is an Upazila of Cox's Bazar District in the Division of Chittagong, Bangladesh. It forms the southernmost point in the mainland of Bangladesh (St. Martin's Island is the southernmost point). The name of the region comes from the NAF River which forms the eastern boundary of the Upazila. It shares the border with Myanmar [3].

Teknaf is located at 20.8667°N 92.3000°E. It has 23,675 households and a total area of 388.68 km^2. The tidal range at the Teknaf coastal area is strong influenced by the NAF river estuary. The area has a warm tropical climate and sufficient rainfall to enable it to support a wide biological diversity [3].

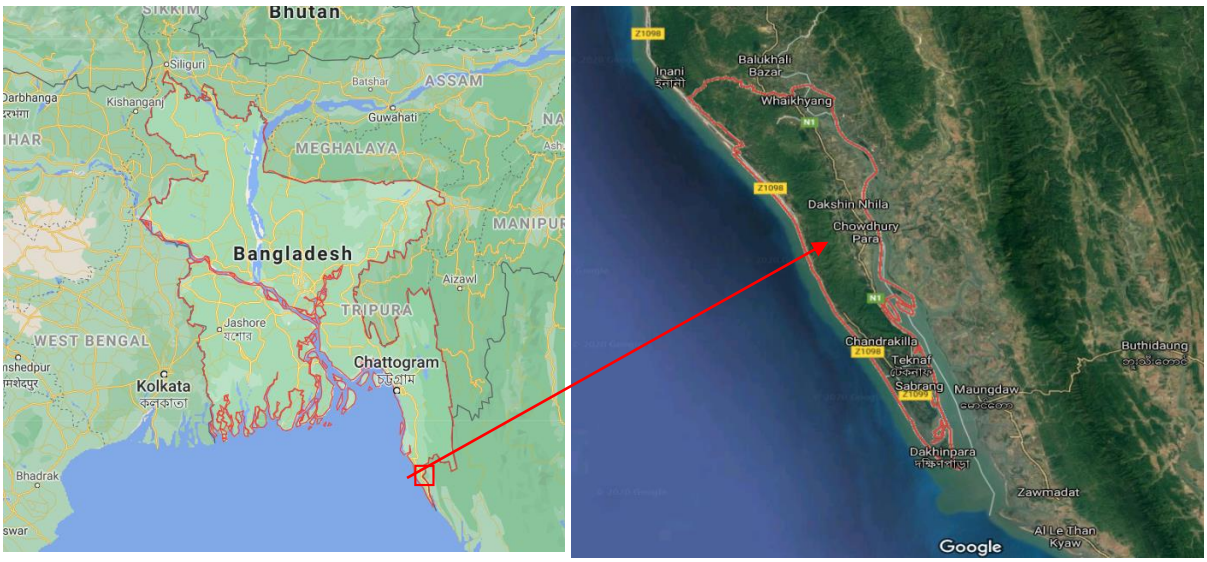


Figure 0-1: Geographical view of Teknaf

According to the 1991 Bangladesh census, Teknaf had a population of 152,557. Males constituted 51.81% of the population, and females 48.19%. The population aged 18 or over was 64,417. Teknaf had an average literacy rate of 16.6% (7+ years), against the national average of 32.4%. Teknaf has 6 Unions/Wards, 13 Mauzas/Mahallas, and 133 villages. The six unions are Teknaf Union, Hnila Union, Baharchhara Union, Sabrang Union, Whykong Union, and St. Martin Dip [4].

Teknaf Peninsula is one of the longest sandy beach ecosystems (80 km) in the world. It represents a transitional ground for the fauna of the Indo-Himalayan and Indo-Malayan ecological sub-regions [5]. Important habitats at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons, and marine habitats. Mangrove forest occurs in Teknaf peninsula both as a natural forest with planted stands and mostly distributed in the inter-tidal zone. The Teknaf peninsula mangroves support the habitat of 161 different species of fish. Teknaf reserved forest is one of the oldest reserved forests in Bangladesh [5].

(a) Marin Drive Road

(b) Teknaf beach point

(c) Natural beauty of Teknaf Beach Point

(d) Natural beauty of Marin Drive Road

Figure 0-2: Geographically importance of Teknaf

1.2 The Project Site

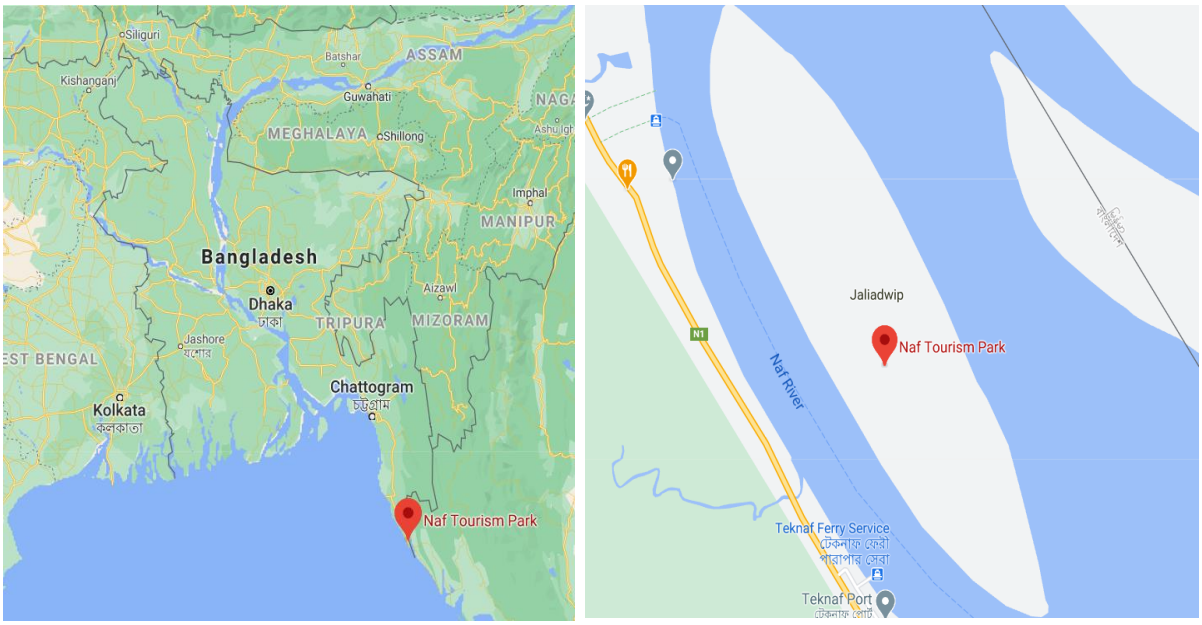
Naf Tourism Park will be the first island-based tourism park in Bangladesh encompassing an area of 271 acres. Naf Tourism Park is located on an egg-shaped island raised in the middle of the Naf River under Teknaf Upazila of Cox's Bazar. It has scenic Beauty with a hill view on both Myanmar and Bangladesh [6].

Connectivity:

- Located beside the Teknaf-Cox's Bazar road.
- Only 90 km away from Cox's Bazar Airport
- Teknaf Land Port only 0.4 km from the tourism park
- A cable car connection will be constructed from Ne-Taung Hill to Naf Tourism Park (8.5km).

Speciality of Naf Tourism Park

- Theme cruise for St. Martin Coral Reef Island
- 5 star hotel, Restaurant, Honeymoon Park
- Multi formatted Food Court & Themed Pavilions
- Jungle, jogging Tracks, Night Camps, Eco-Friendly Resorts
- Mini-Golf Course, Light & Sound Show
- Entertainment Zone
- Infant Swimming Pool and Cable Car
- Sky Bridge
- Oceanarium, Water Sports Complex
- Game Parlors, Birds Watching, and View Tower
- Harbor Bridge
- Cable Car Hanging
- Hanging Bridge



(a) Naf Tourism Park geographical view (b) Naf Tourism Park close view

Figure 0-3: Naf Tourism Park location

The transport facilities are one of the important issues for any kind of development project. Only a bus station is the main medium to connect with the area. There is no previous traffic survey report in this area. Besides, the area is being developed day by day which is the concern for massive problems in future. Currently, this area induced several development projects where Naf Tourism Park is most important. For the park establishment, the existing

road condition and traffic impact assessment is a talisman for the area traffic forecast. This study mainly focuses on the present and future perspective of traffic impact in the locality.

The main objectives of this study are to assess current traffic and road conditions and to predict future traffic which helps to reduce traffic-related problems without hindering development project in this locality.

1.3 The Study Objectives

The objective of this paper is divided into two categories, main objectives, and specific objectives.

Main Objectives:

The main purpose of this study is to assess the traffic impact for construction of the Cable Car project with Naf Tourism Park in Teknaf area.

Specific Objectives:

- To know Origin- Destination (OD) of vehicles and passengers.
- To determine Annual Average Daily Traffic (AADT) of the existing roads of the study area.
- To determine speed and delay of the study areas roads.
- To analyze Level of Services (LOS) of the existing road condition.
- To calculate vehicle compositions of the study area.
- To predict future volume of traffic in the study area.
- To analyze footpath Level of Services (LOS).
- To analyze willing to pay (WTP) conditions of the study area.
- To to existing transportations infrastructures and facilities.
- To explore the traffic impact of the project area after constructions of the cable car at Naf Tourism Park.

CHAPTER 2: STUDY METHODOLOGY

2.1 Conceptual Framework

The conceptual framework of this study is designed based on the previous traffic impact assessment literature. The frame is started on reviewing previous literature and end with the outcome of this study. Field visit is for preliminary concept about study area which gives basic information in the locality. Inventory survey includes the important location in the locality and some opinion of the local people about the study area which helps to make final questioner survey form. The data collection is mainly based on the traffic survey and willing to pay survey. Finally, the survey data is analyzed and visualized. The final recommendation is based on the outcome of the study.

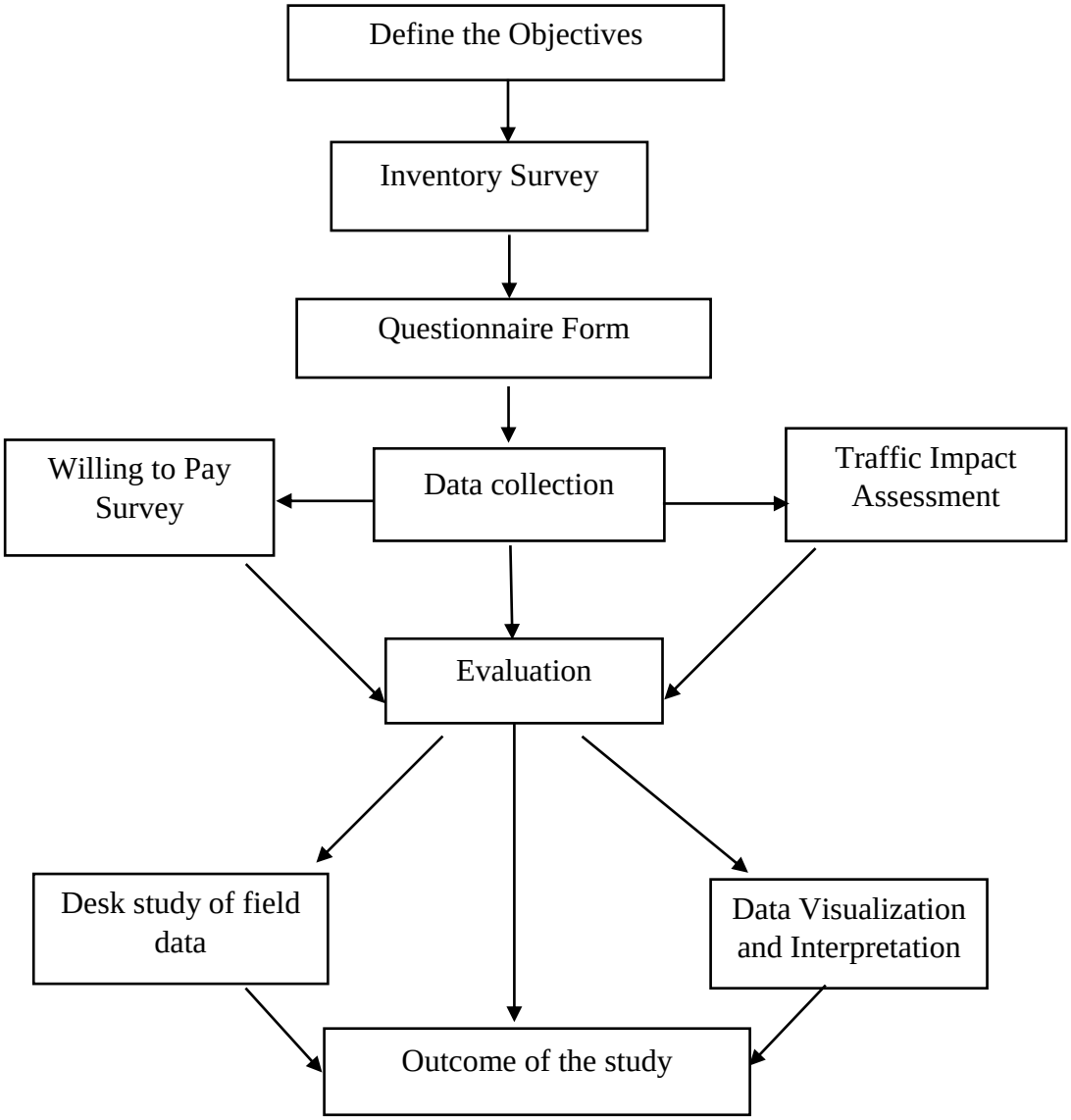


Figure 2-1: Methodology of the Study

2.2 Survey Design

Traffic survey and willing to pay survey is carried out in three selected route in the study area. Those routes are selected based on the geographic importance and those routes are connected with NAF Tourism Park. The willingness to pay survey 3 days and traffic survey is made on those three roads employing 12 surveyors in 2 days from 7 am to 7 pm (12 hours).

Route 1: Teknaf-Cox's Bazar Road

Route 2: Old Marine Drive Road (LGED Road)

Route 3: New Marine Drive Road

Figure 2-2: Study route geographical view

2.3 Traffic Survey Locations

The traffic survey is done in three locations which is considered the geographically important and maximum number of vehicle pass through those points. Place 1 (Teknaf Bus Stand) which is the main entry in Teknaf town, Place 2 (Parjatan Bazar) is in the old marine drive road which is the main entry road for entering cable car project site for the Naf tourism park, Place 3 (Teknaf Beach Point) is the alternative entry to reach Teknaf town which is considered as the busiest and dangerous road in Teknaf region.

Place 1: Teknaf Bus Stand Point (Route 1)

Place 2: Parjatan Bazar Point (Route 2)

Place 3: Teknaf Beach Point (Route 3)

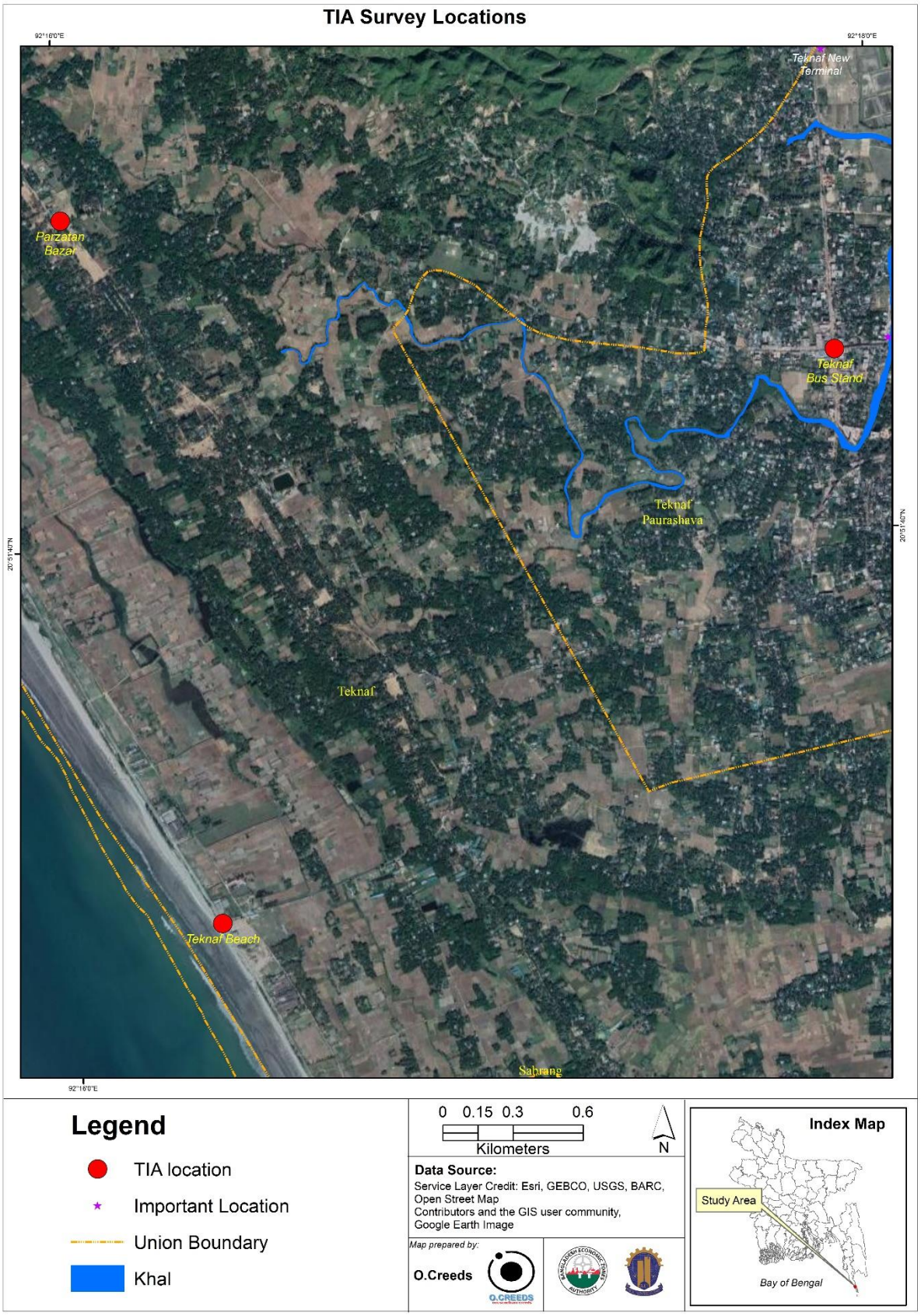


Figure 2-3: Traffic data collection location map

(a) Teknaf Bus Stand point

(b) Parjatan Bazar Point

(c) Teknaf Beach Point

Figure 2-4: Traffic data collection location

2.4 Willing To Pay Survey Location

Willing to pay survey was carried out within the cordon line area (Figure 2-4). The survey was done taking interviews in different households, passersby, vehicle drivers, shop owners, tourist people. Almost 350 data was collected which includes demographic, socioeconomic aspect, and their opinion to the NAF tourism park. The area is divided into three portions for the betterment of the study. The data was collected in two-shift first shift from 7 am to 2 pm and the second shift from 2 pm to 7 pm. The places are

Area 1: Teknaf Town Area

Area 2: Parjatan Bazar Area

Area 3: Teknaf Beach Point Area

Figure 2-5: Cordon line for willing to pay survey

Table 2-1: Willing to pay survey

Point	1st Shift	2nd Shift	Total
Teknaf Town Area	84	69	153
Teknaf Beach Point Area	37	65	102
Parjatan Bazar Area	50	45	95
Total	171	179	350

2.5 Data Collection Tools and Materials

Tools: For data collection purpose different instrument was used like, safety vest, cap, clipboard, pencil, eraser, sharpeners, and stopwatch. A Special photo was taken like interview photo, group photo, road condition photo, and vehicle photo using a high-resolution camera. Paratransit was used to travel to different locations.

(a) Group photo of workers

(b) Survey photo

(c) Travel photo

Figure 2-6: Data collection details

Sample Size: The willingness to pay sample size is 350 after screening 400 data. Total traffic count for weekday is 16110 and weekend is 11664.

Survey Duration: The duration of the survey was 12 hours (7 am to 7 pm).

Survey Day: The survey was carried out on weekdays (2/9/20 and 3/9/20) and weekends (4/9/20).

Manpower: Total of twelve surveyors were employed for the survey.

Communication Medium: Paratransit

2.6 Various Survey Description

2.6.1 OD Survey

OD survey provides the details picture of the trip patterns, travel mode choices in a region. The OD survey was conducted at the vehicle stoppage and start point in Teknaf. The three main roads stop and start points were surveyed rigorously (Route 1, Route 2 and Route 3). Three points are Teknaf Bus Stand point, Parjantan Bazar point, and Teknaf Beach point. The

data was taken in two-shift which are first shift (7 am-2 pm), and second shift (2 pm-7 pm). In the survey mainly focused on the number of trip generation or how many vehicles stopped and started in the places.

Figure 2-7: Origin- Destination survey

2.6.2 AADT Survey

Average Annual Daily traffic is the total volume of vehicle or traffic count divided by 365 days in a year. It gives a clear view of how busy the road is. It helps to improve future road conditions. The AADT survey was conducted on the three important locations which are Teknaf Bus stand, Parjatan Bazar, and Teknaf Beach. The survey was conducted by employing 12 people weekday is 16110 and weekend is 11664.

(a) Vehicle count at Teknaf Bus stand point

(b) Vehicle count at Parjatan Bazar point

Figure 2-8: Field data collection

Average Annual Daily Traffic (AADT) Calculated by using following formula:

• Hourly Expansion Factors, HEF = $\frac{Total\ 24\ hour\ volume}{Volume\ for\ particular\ hour}$

These factors are used to expand counts of durations shorter than 24 hour to 24 hour volume.

• Daily Expansion Factors, DEF = $\frac{Average\ total\ weekly\ \ volume}{Average\ volume\ for\ particular\ day}$

These factors are used to determine weekly volume from counts of 24 hour duration.

•Monthly Expansion Factors, MEF = $\frac{AADT}{ADT\ \ for\ particular\ month}$

These factors are used to determine AADT from the ADT for a given month.

AADT = MEF* ADT for particular month

2.6.3 Speed and Delay Analysis

This survey gives a clear view of the traffic condition for the existing road. It helps to identify delay cause and helps to reduce traffic congestion. For this study, we measure free-flow speed and normal flow speed for Route 1, Route 2, and Route 3. Free-flow speed was taken in the place where no obstruction like market, institution, etc. Normal flow was taken in the place where obstruction like market, institution, etc. exist. The two types of flow were measured for each vehicle category in the routes. Those data helps to determine the amount of delay each vehicle faces in the three routes.

For calculation of free flow speed and normal flow speed, a strip of 88ft was considered and then the time of passing this strip for each vehicle was recorded. Free flow and normal flow speed were calculated using the following formula:

V= S/t

Where,

S= is the travel distance

V= is the speed of the vehicle

t = is the time required for travel distance

Delay = Time required in normal flow conditions – Time required in free flow conditions

For delay calculation considered travel distance 87 km (Route 1), 14km (Route 2), and 80 km (Route 3) respectively.

(a) 88 ft. length measure (b) Road width measure

Figure 2-9: Speed and delay survey

2.6.4 LOS for the Existing Road Condition

Level of Service denotes the level of facility that can be derived from a road under different traffic volumes and operating conditions. The concept of level of service is defined as a qualitative measure of the operating conditions in a traffic stream and the perception of these conditions by drivers and passengers.

Capacity is the ability of a road to accommodate traffic volume. It is the maximum hourly rate at which vehicles can reasonably be expected to cross a point on a roadway during a given time period under prevailing traffic roadway and control condition.

Traffic Volume is the number of vehicles crossing a section of road per unit time at any selected period.

Few purposes of traffic volume study:

- To establish the relative importance of any route or road facility
- To decide the priority for improvement and expansion of a road and to allow the funds accordingly.
- To plan and design the existing and new facilities of traffic operations on the road.
- To make analysis of traffic patterns and trends on the road.
- To do structural design of pavements and geometrically design of roads by classified traffic volume study.
- To plan one-way street and other regulatory measures by volume distribution study.
- To do the design of road intersections, planning signal timings, and channelization by turning movement study.
- To do planning of sidewalks, crosswalks, and pedestrian signals by pedestrian volume study.
- To do economic studies after estimating the highway user's revenue.

To evaluate traffic condition in cities, volume-capacity Ratio (v/c) is one of the most used measures of effectiveness for determining LOS, in which v is the total number of vehicles passing a point in one hour and c is the maximum number of vehicles that can pass a certain point at the reasonable traffic condition. Volume-capacity Ratio (v/c) is a measure that reflects the mobility and quality of travel of a facility or a section of a facility. It compares roadway

demand (vehicle volumes) with roadway supply (carrying capacity). The v/c method is associated with LOS and determining how well a roadway is performing. This measure can alert transportation providers to areas where traffic mitigation measures should be considered. V/c ratio was calculated by the following formula [7] [8]:

c = NSg/ C

Where,

c=capacity (pcu/hr)

N = number of lanes (ln)

S = saturation flow rate (pcu/hr/ln)

g =effective green time (sec)

C = cycle time. (Sec)

Volume-capacity ratio = Total hourly PCU / Capacity

Table 2-2: Traffic performance measurement by v/c ratio (HCM, 2010).

LOS	v/c Ratio	Detailed Description
A	0.00-0.35	Represents the best-operating conditions and is considered free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.
B	0.35-0.58	Represents reasonably free-flowing conditions but with some influence by others.
C	0.58-0.75	Represents a constrained constant flow below speed limits, with additional attention required by the drivers to maintain safe operations. The comfort and convenience levels of the driver decline noticeably.
D	0.75-0.90	Represents traffic operations approaching unstable flow with high passing demand and passing capacity near zero, characterized by drivers being severely restricted in maneuverability.
E	0.90-1.00	Represents unstable flow near capacity. LOS E often changes to LOS F very quickly because of disturbances (road conditions, accidents, etc.) in traffic flow.
F	>1.00	Represents the worst conditions with the heavily congested flow and traffic demand exceeding capacity, characterized by stop-and-go waves, poor travel time, low comfort and convenience, and increased accident exposure.

(a) Broken footpath

(b) Pavement distress

(c) Narrow road

(d) Road facilities

Figure 2-10: Existing road condition survey

2.6.5 Vehicle Composition Analysis

Vehicle composition analysis is the summary of a particular vehicle number or percentage in the total amount of vehicle. It illustrates a clear view of various traffic in the approach. For this study purpose we counted vehicles in three main roads (Route 1, Route 2, and Route 3). The result will help policymakers and transportation planners to take correct decisions.

(a) Car

(b) Mini Bus

(c) Van

(d) Paratransit

Figure 2-11: Vehicle composition survey

2.6.6 Future Traffic Volume Analysis

Future traffic volumes have been projected every year. These projections are based on many factors, including:

- Population projections for the areas served by the road
- Anticipated growth of cities
- Anticipated growth of business traffic on the road
- Connections to recreation or tourist activities
- Directness of the route
- Character of the roadway
- Anticipated transportation trends
- Land development patterns

To predict future volume of traffic considered 15% induced traffic with the present volume for the tourist season and also considered annual growth rate 10% per year [10][11].

The Volume of future traffic calculated using following formula:

$$F = P\ (1 + r)^n$$

Where,

F = is the future volume of traffic

P = is the present volume of traffic

r = is the annual growth rate

n = is the number of period

(a) Road condition

(b) Footpath condition

(c) Footpath width

(d) Narrow road

Figure 2-12: Future traffic volume analysis survey

2.6.7 Pedestrian Level of Service Analysis

Pedestrian level of service (LOS) is an overall measure of walking conditions on a route, path, or facility. This is linked directly to factors that affect mobility, comfort and safety, reflecting pedestrian's perceptions of the degree to which the facility is pedestrian-friendly.

To analyze pedestrian flow rate considered 9 km segment of Route 1, 11 km segment of Route 2, and 12 km segment of Route 3[8].

Table 2-3: HCM Average flow criteria for assessing the LOS of Pedestrian.

LOS	Pedestrian Space (ft^2/ped)	Pedestrian Flow Rate (Ped/min/ft)
A	> 60	< 5
B	>40-60	> 5-7
C	>24-40	> 7-10
D	>15-24	> 10-15
E	> 8-15	>15-23
F	< 8	Variable

2.6.8 Willing To Pay Survey:

WTP survey helps to know the people's opinions regarding any development work. For our study, we surveyed the cordon line area. The survey was done by employing 12 surveyors from 2 to 4 September 2020 in three areas (Area 1, Area 2, and Area 3). The questions are based on the demographic and socio-economic conditions, and people's opinions about the Naf Tourism Park. In demographic survey includes gender, age, education, occupation, monthly income, frequency of travel, origin-destination. The question about Naf Tourism includes road facilities, like tourism or not, etc. The details of the question are attached in the appendix section.

(a) Interview at office

(b) Interview at house

(c) Interview at Bazar

(d) Interview at street

Figure 2-13: Willing to pay survey

CHAPTER 3: EXISTING TRANSPORTATION INFRASTUCTURE AND FACILITIES

3.1 Transport Network with Segment

Teknaf – Cox's Bazar road is the main entry of Teknaf which is in the Int. #01. The road is connected with two main roads which are Old Marine Drive road and New Marine Drive road. The Old Marin Drive road is in Int. # 05 and New Marine Drive road is in Int. # 04. That road has different geometric designs and a lack of various facilities. The Old Marine Drive road will be connected with cable car projects which will be affected by development.

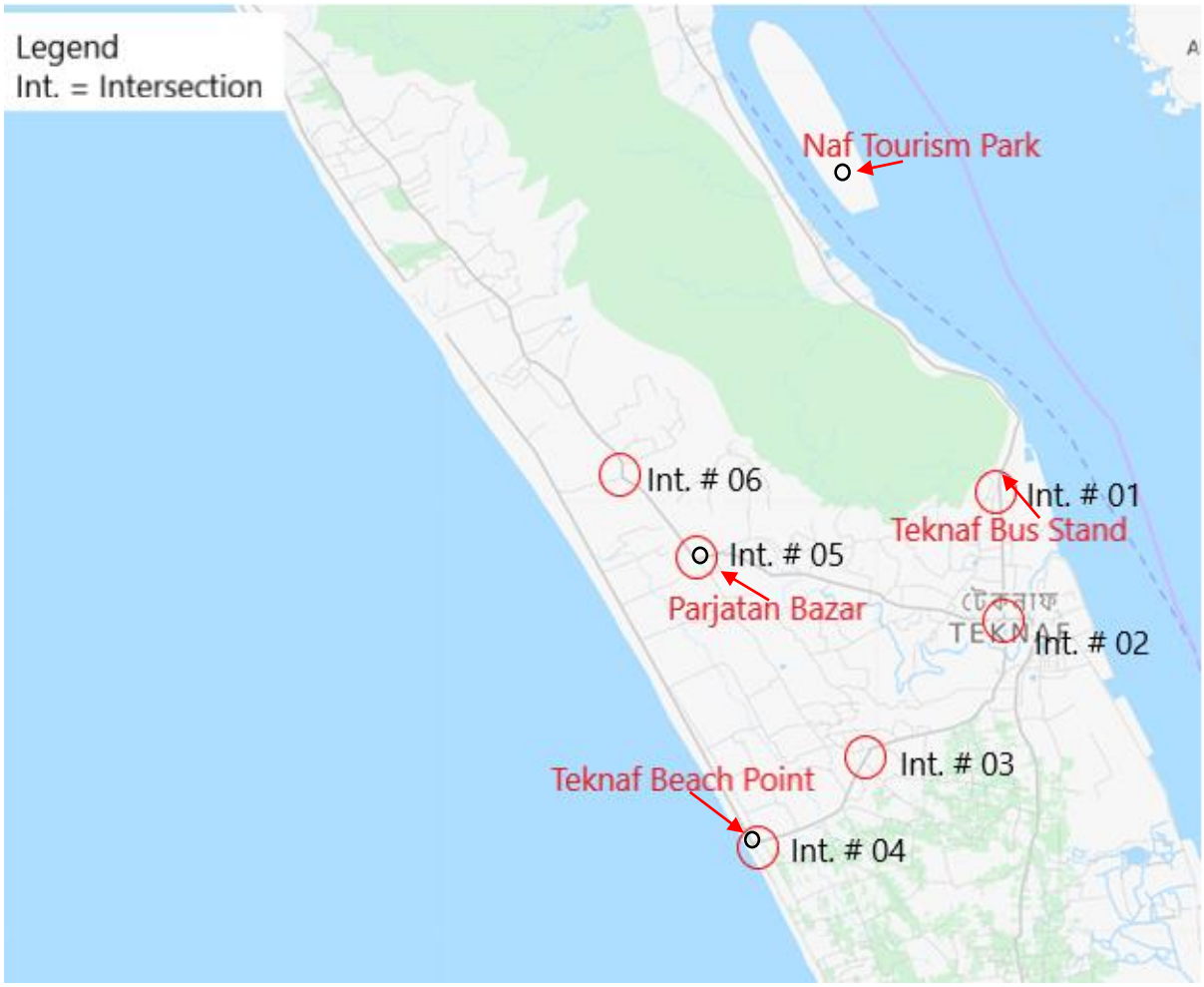


Figure 3-1: Important road intersection of Teknaf

3.2 Existing features and infrastructure facilities

Traffic Impact Assessment (TIA) preparing team visited the study area several times to observe the existing transportation infrastructure and facilities available. Teknaf is the southernmost Upazila of Cox's Bazar. Various traffic from different parts of the country uses this area for various purpose. To provide convenient travel facilities to the passenger after the completion of Cable Car project it is required to observe the present conditions of the roads of the project area. The geometry of road sections shown in Figure 3-1, Figure 3-2, and Figure 3-3 are presented in a tabular form below.

Table 3-1: Geometric Features of New Marine Drive Road

Features	Descriptions
Number of Lane	2
Carriageway Width	18 ft
Zebra-crossing	Present
Traffic Sign	Absent
Foot over Bridge	Absent
Speed Breakers	Absent
Traffic signaling	Absent
Street Lights	Absent
Median	Present
Gutter	Absent
Kerb	Absent
Shoulder	Present
Footpath	Absent
Bus Bay	Absent
Potholes	Absent
Cracking	Present
Depression	Absent
Edge Failure	Present

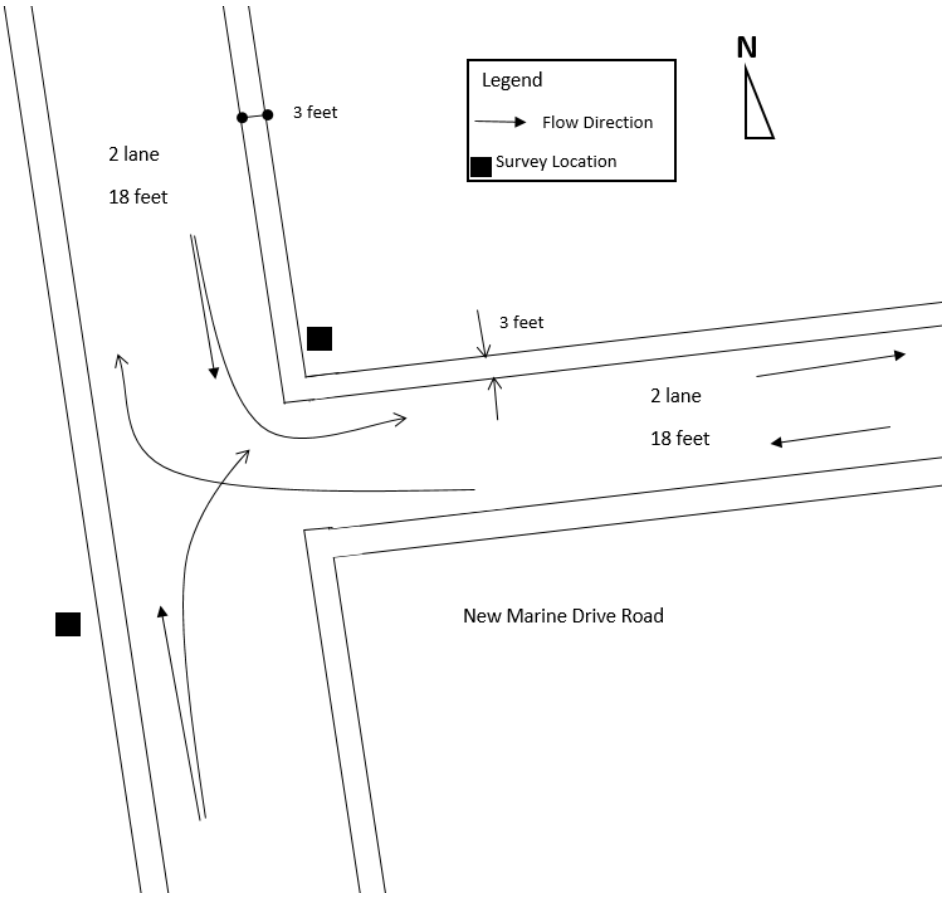


Figure 3-2: New Marine Drive road Teknaf intersection

Table 3-2: Geometric Features of Old Marine Drive Road

Features	Descriptions
Number of Lane	2
Carriageway Width	13 ft
Zebra-crossing	Absent
Traffic Sign	Absent
Foot over Bridge	Absent
Speed Breakers	Present
Traffic signaling	Absent
Street Lights	Absent
Median	Absent
Gutter	Absent
Kerb	Absent
Shoulder	Present
Footpath	Not Sufficient
Bus Bay	Absent
Potholes	Present
Cracking	Present
Depression	Present
Edge Failure	Present

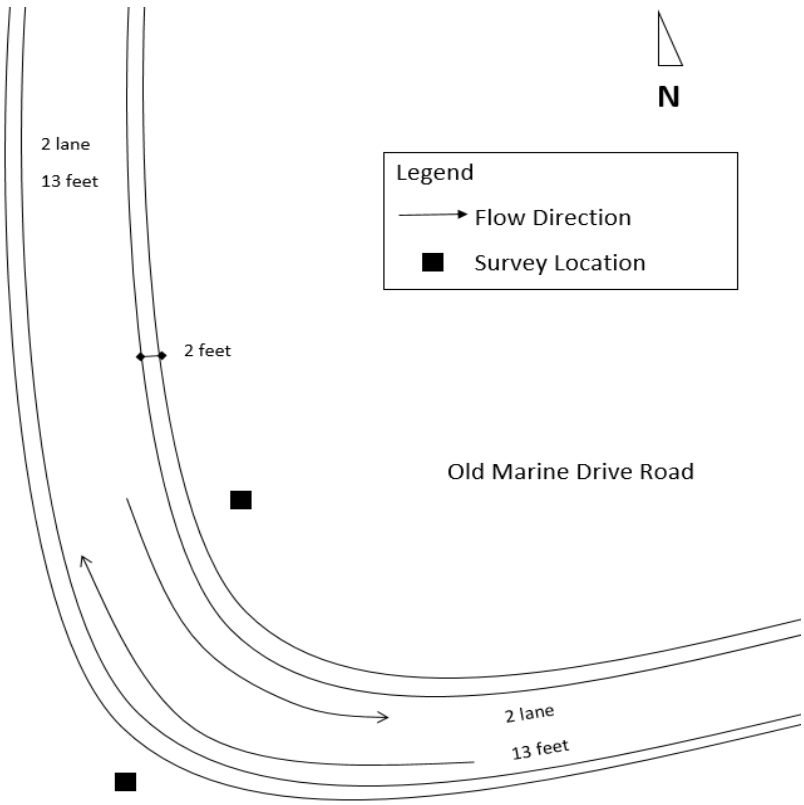


Figure 3-3: Old Marin Drive road (Parjatan Bazar) intersection

Table 3-3: Geometric Features of Teknaf-Cox's Bazar Road

Features	Descriptions
Number of Lane	2
Carriageway Width	18 ft
Zebra-crossing	Absent
Traffic Sign	Absent
Foot over Bridge	Absent
Speed Breakers	Present
Traffic signaling	Absent
Street Lights	Absent
Median	Absent
Gutter	Absent
Kerb	Absent
Shoulder	Present
Footpath	Not Sufficient
Bus Bay	Absent
Potholes	Present
Cracking	Present
Depression	Present
Edge Failure	Present

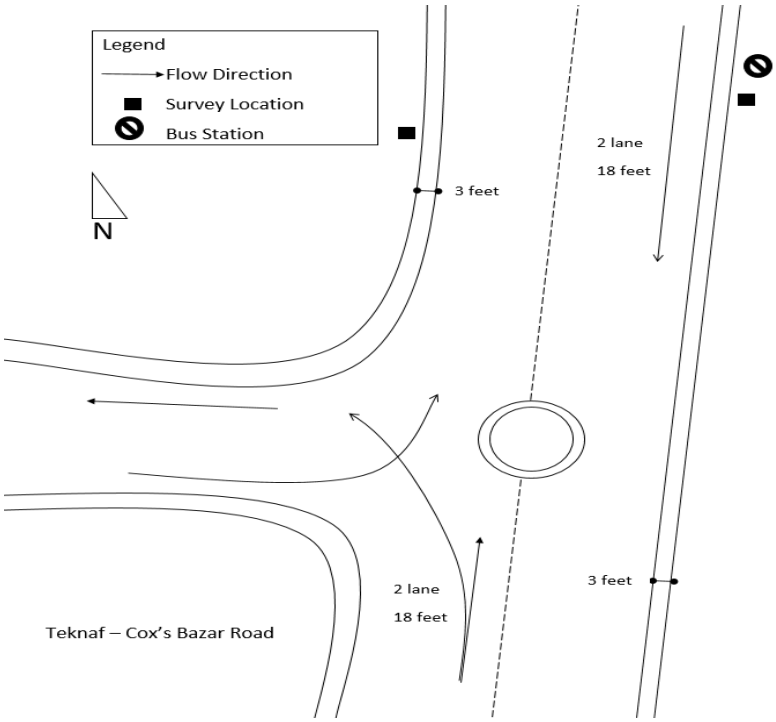


Figure 3-4: Teknaf – Cox's Bazar road intersection

After inspection of the study area, it is seen that the existing geometric features of study areas roads are poor. Most of the geometric features are absent on all roads of the study area. It is clear that existing features and infrastructure facilities must be improved for the proposed Cable Car project.

3.3 Traffic scenario at present

New Marine Drive Road:

Results express that the most dominating vehicle in New Marine Drive road is auto rickshaw rather than other types of vehicles both weekend and weekday and their values are 2060 and 1680 vehicle/day respectively. Auto rickshaw occupancy on road is higher because other public transports are not available on this road so that most of the people of this locality prefer auto-rickshaw to go their destination. The CNG is the second type of vehicle which governs the maximum number in this road which contains 1143 vehicle/day in weekday and weekend. Microbus, Motorbike, and car are medium governing vehicles both on weekdays and weekend days. The percentage of the motorbike is double in the weekend than weekday because people of the surrounding area come to see the beauty of the Bay of Bengal on the weekend days via motorbike. The presence of trucks, buses, and NMT in this road is less amount compared to other types of vehicles because public buses, heavy trucks are not allowed to travel through this road and maximum people travel by rickshaw and CNG (Figure 3-5 & Figure 3-6).

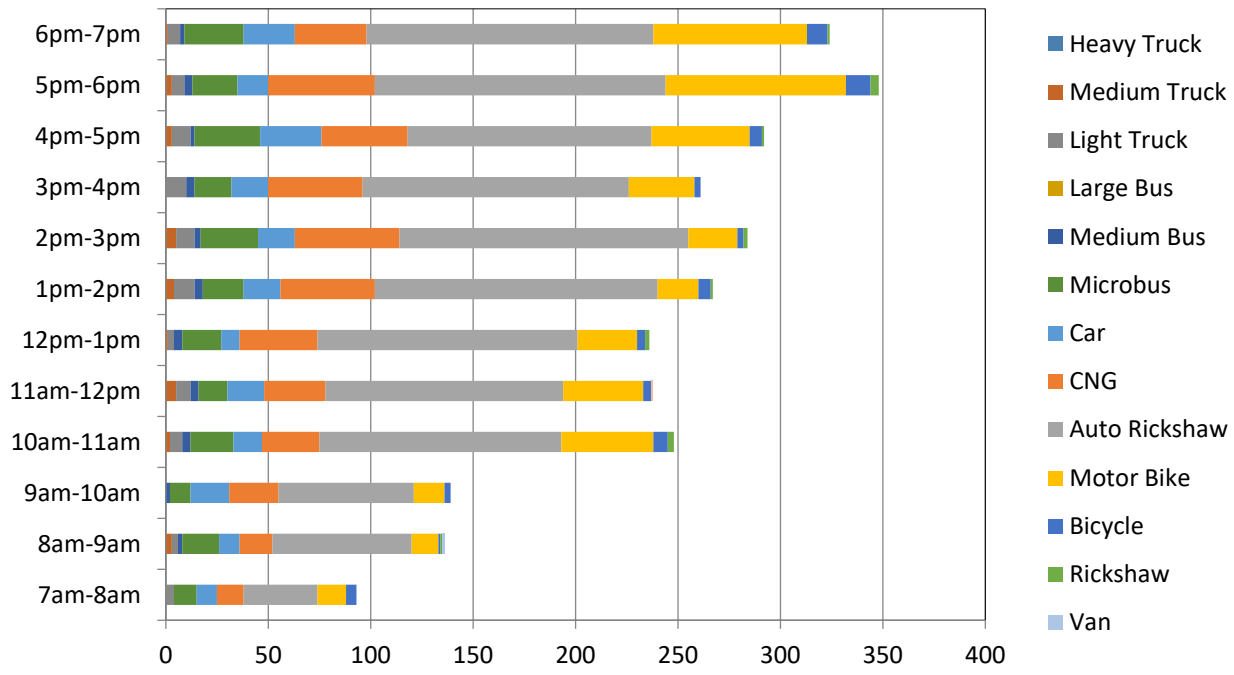


Figure 3-5: Total hourly traffic volume at New Marine Drive Road in Weekday

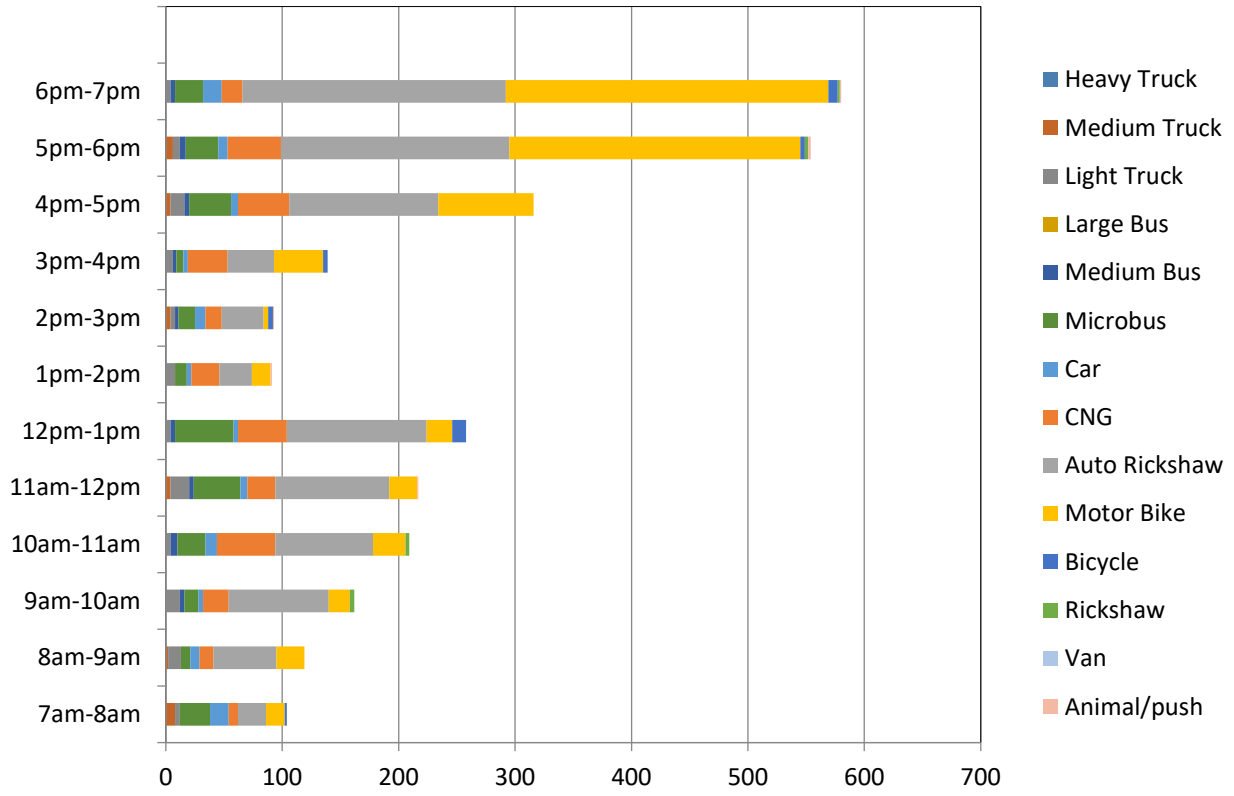


Figure 3-6: Total hourly traffic volume at New Marine Drive Road in Weekend

Old Marine Drive Road:

The study has discovered that the most influencing vehicle is Auto Rickshaw in the Old Marine Drive road at weekday and weekend and their values are 2256 and 2100 vehicle/day respectively. This road also called Parjatan Bazar road and this road mainly passes through the rural area, and public transports (Bus, laguna, etc) are not available to travel to facilitate most of the people surrounding this road use auto-rickshaw to travel their destination. From the survey, it is seen that motorbike and CNG are the moderate dominating vehicle both in weekday and weekday. However truck, microbus, car, and NMT are not significant in this road. This road contains the minimal volume of traffic compares to the other two roads of our study area because of the new connecting road of Teknaf- Cox's Bazar road to Marine Drive road (Figure 3-7 & Figure 3-8).

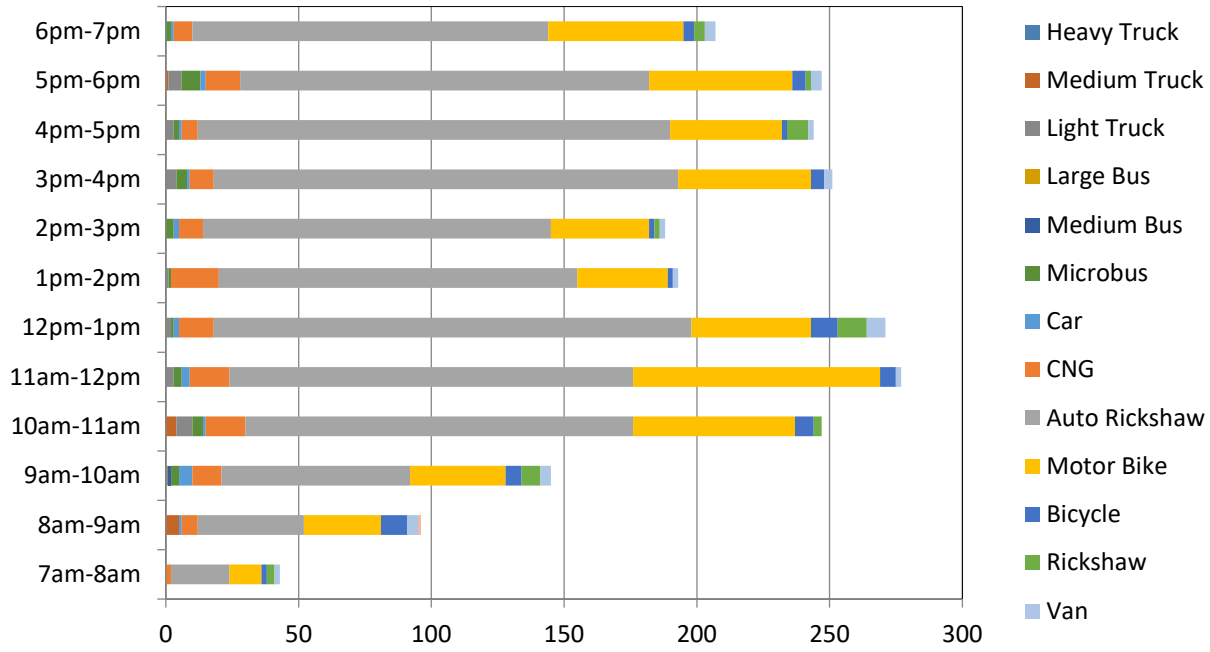


Figure 3-7: Total hourly traffic volume at Old Marine Drive Road in Weekday

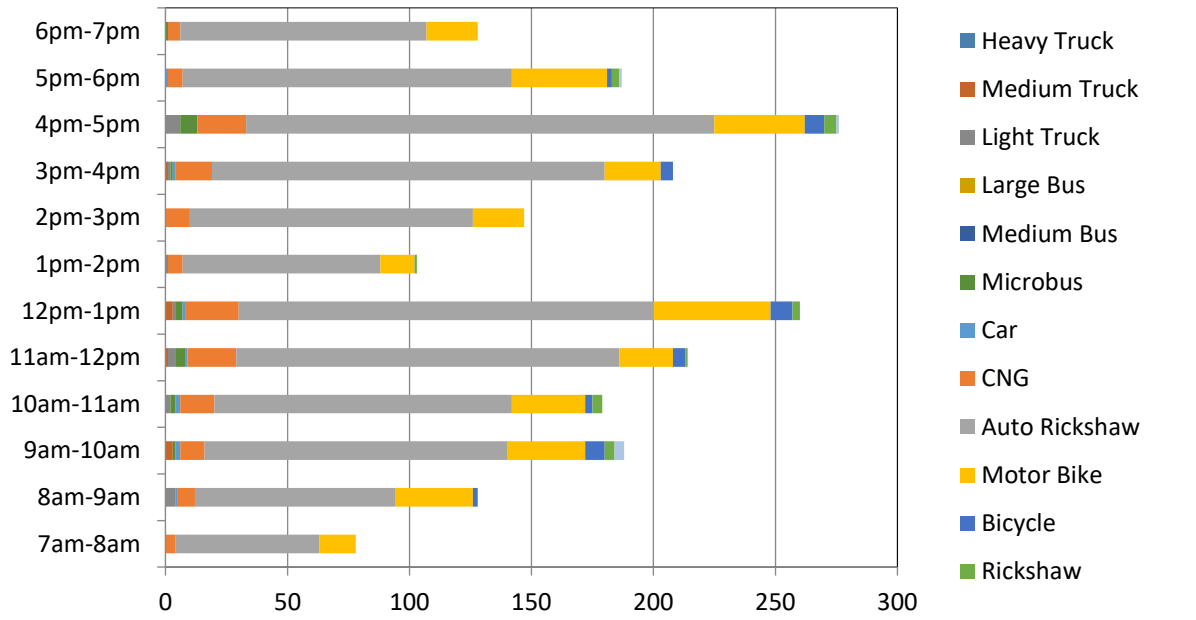


Figure 3-8: Total hourly traffic volume at Old Marine Drive Road in Weekend

Teknaf-Cox's Bazar Road:

This road connects Teknaf with Cox's Bazar, Chittagong, and Dhaka directly. In this road, the most dominant vehicle on weekdays and weekends is the auto-rickshaw which contains 8113 and 2690 vehicle/day respectively. The next influencing vehicle in this road is CNG on weekday which contains 841vehicle/day and Microbus at weekend which contains 393 vehicle/day of the total traffic. Car, motorbike, and medium truck are the medium dominating vehicle. Several percentages of bus travel through this road because this is the only road to travel Dhaka, Chittagong, and other parts of Bangladesh from Teknaf by bus. The heavy truck

contains 14 vehicle/day on weekdays and 21vehicle/day at weekends because Teknaf is a tourist area and there is no industry (Figure 3-9 & Figure 3-10).

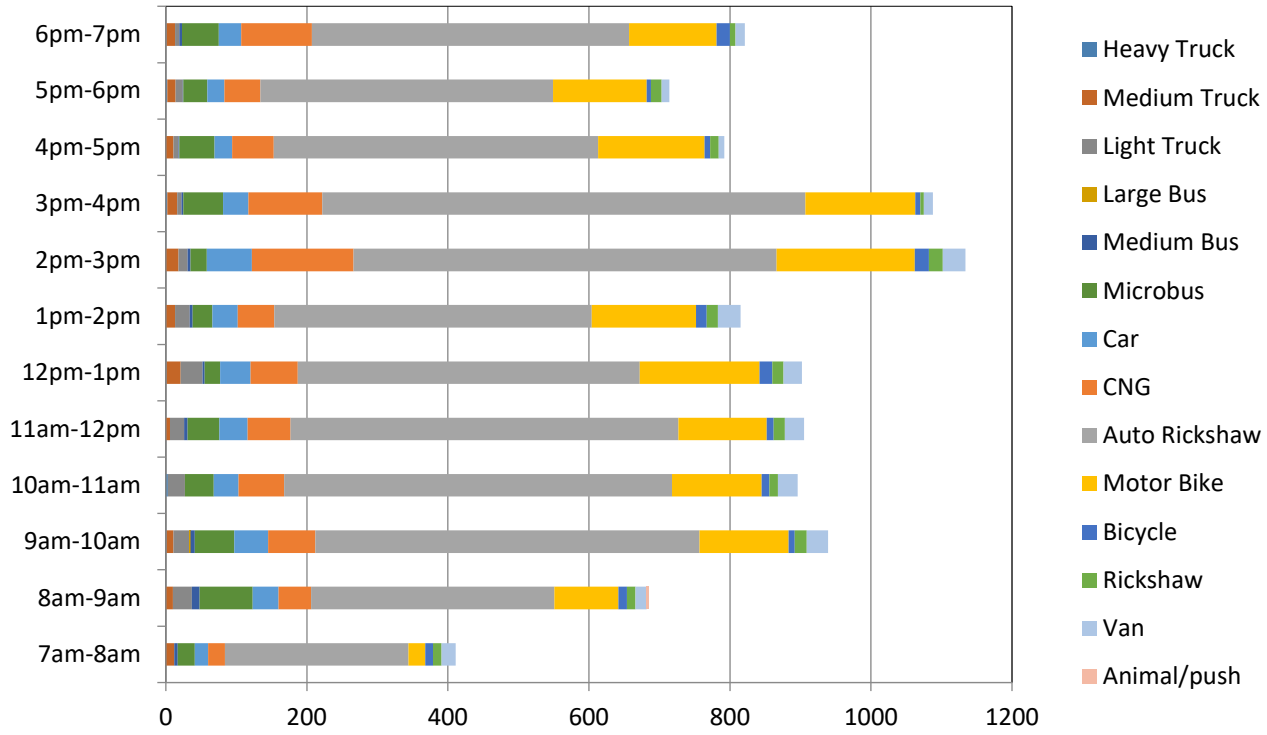


Figure 3-9: Total hourly traffic volume at Teknaf-Cox's Bazar Road in Weekday

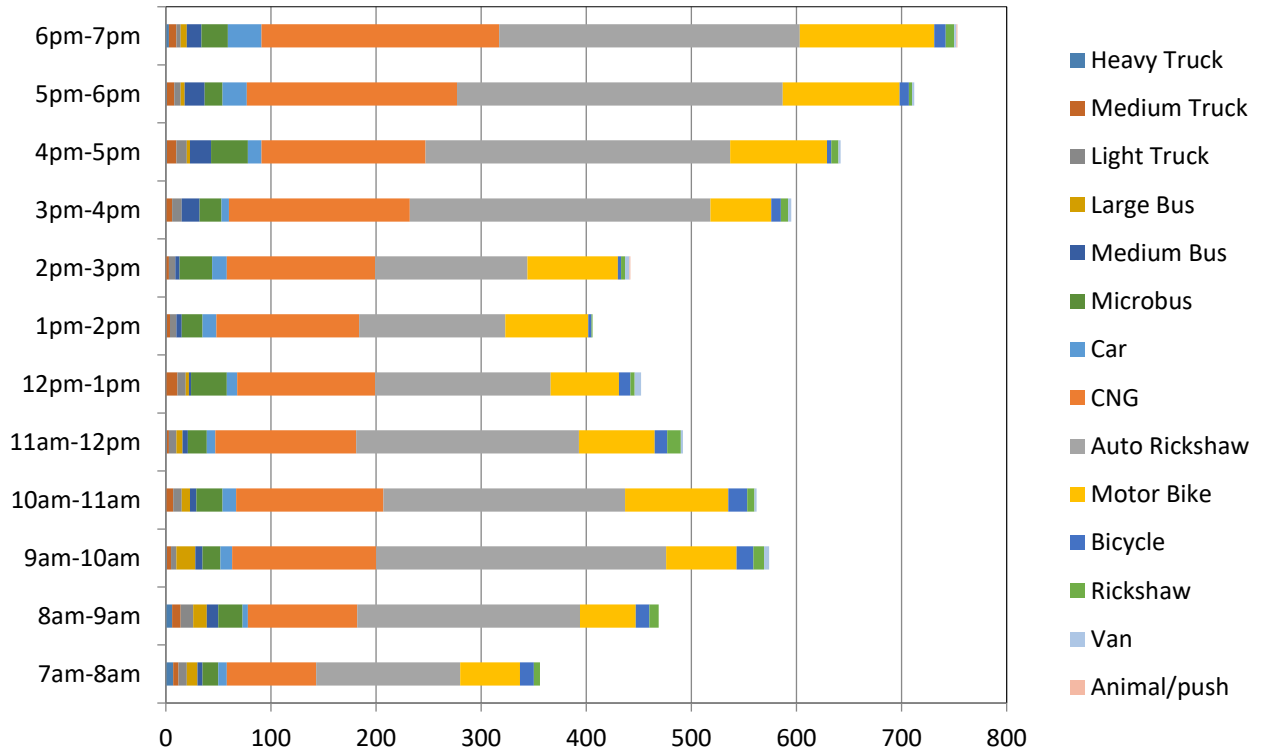


Figure 3-10: Total hourly traffic volume at Teknaf-Cox's Bazar Road in Weekend

Flow Fluctuation Conditions:

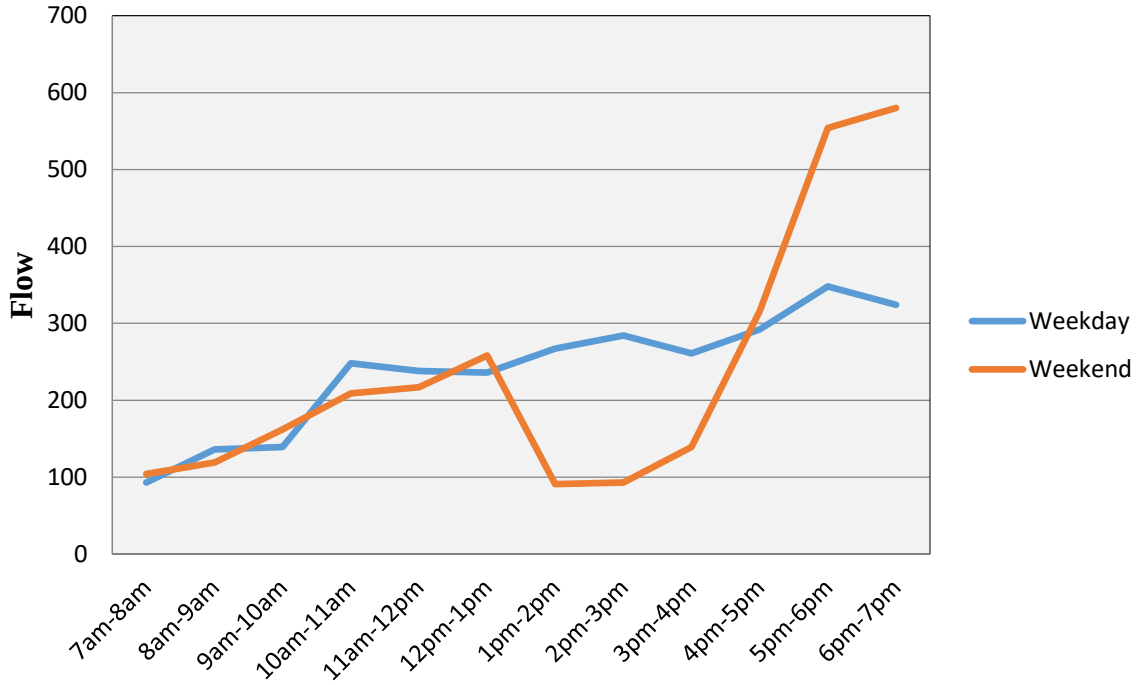


Figure 3-11: Flow Fluctuation curve of New Marine Drive Road

Flow fluctuation curve (FFC) of New Marine Drive road expressed that traffic flow is high at weekday and weekend day evening time. Peak traffic flow has been observed on weekend evening. Most of the people like to spend their leisure time in the sore of the sea beach especially in the evening time that's why evening time contains high flow (Figure 3-11).

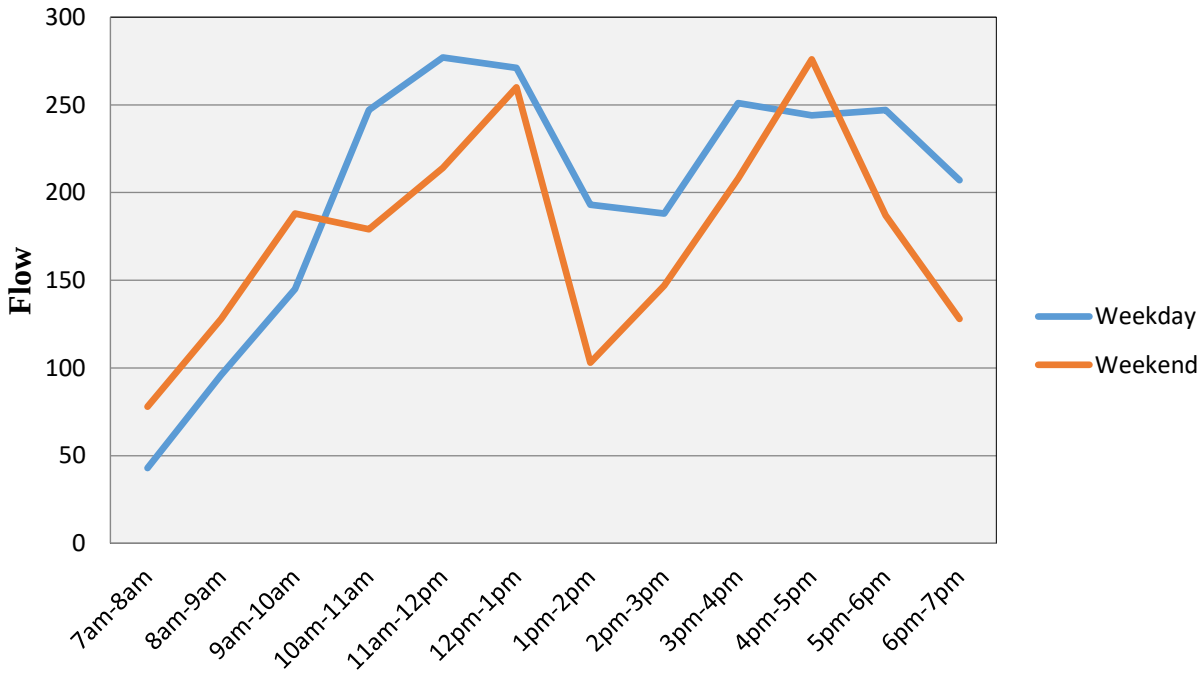


Figure 3-12: Flow Fluctuation curve of Old Marine Drive Road

The analysis shows that average traffic flow is high in weekday at Old Marine Drive Road. The morning peak has been observed in weekend, the afternoon peak has been observed in weekday, and the Evening peak also observed in weekend. Flow rate decrease between afternoon and evening time mostly. (Figure 3-12)

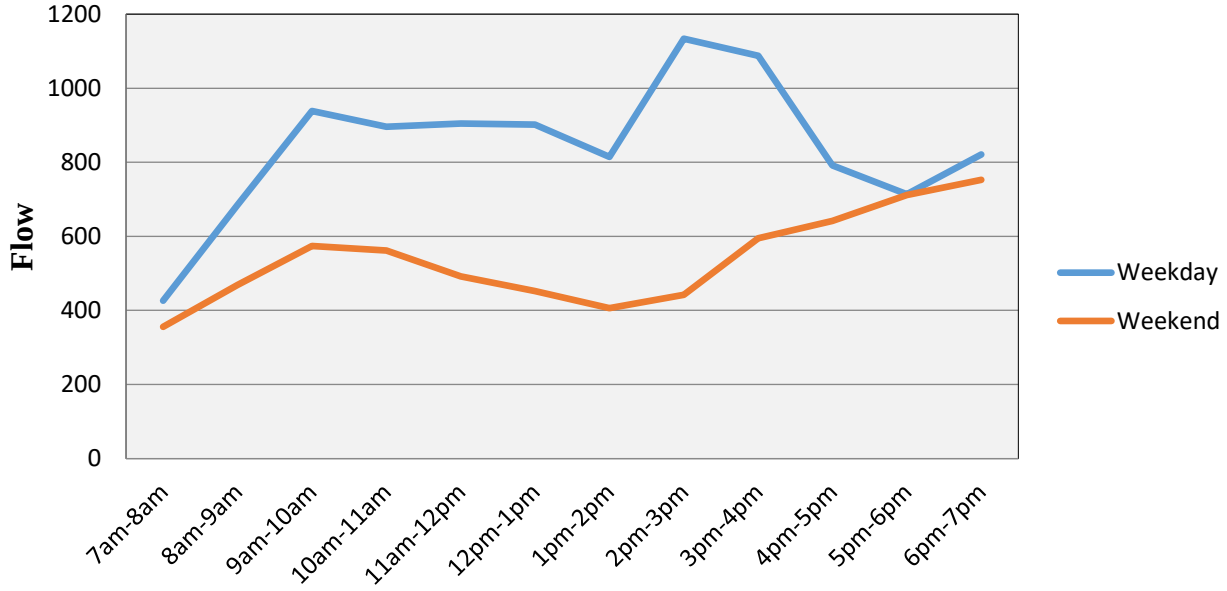


Figure 3-13: Flow Fluctuation curve of Teknaf-Cox's Bazar Road

Figure 3-13 expresses that traffic flow is high in weekday for Teknaf- Cox's Bazar Road. Most of the service-holders use this road to reach their workplace that's why traffic flow is less at weekend. Morning peak, Afternoon peak, and evening peak has been observed at weekday. The overall hourly traffic flow rate is high in this road among all roads of the study area.

CHAPTER 4: DATA ANALYSIS AND RESULTS

4.1 Traffic Analysis

4.1.1 Passenger Car Unit (PCU):

Highway facilities in Bangladesh are used by different classes of vehicles such as cars, buses, trucks, vans, auto-rickshaws, motor-cycles, bicycles, bullock-carts, and so on. The characteristics of this heterogeneous or mixed traffic flow are complex compared to homogenous traffic consisting of passenger cars only. To facilitate the estimation of traffic volume and traffic capacity while dealing with mixed traffic conditions, it is imperative that a common standard vehicle is chosen and all other types are converted into this class of vehicle; the standard vehicle chosen for this purpose is the passenger car. The common unit, therefore, is the passenger car unit (PCU) [9] [12].

Table 4-1: PCU factor for each category of vehicle According to RHD.

Vehicle Type		PCU Equivalency
Motorized Vehicle	Heavy Truck	2.5
	Medium Truck	2.5
	Light Truck	1.25
	Large Bus	2.5
	Medium Bus	2.5
	Microbus	1.25
	Taxi/Car	1
	CNG	1
	Auto Rickshaw	0.5
	Motor Bike	0.3
Non-Motorized Vehicle	Bicycle	0.3
	Rickshaw	1
	Van	0.5
	Animal/push	0.5

4.1.2 Vehicle Compositions Analysis

New Marine Drive Road:

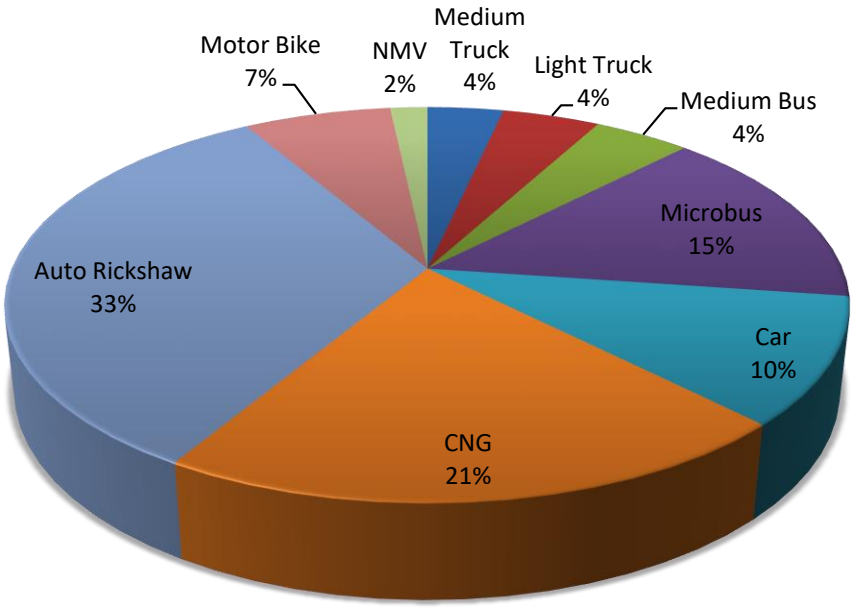


Figure 4-1: Vehicle Compositions of New Marine Drive Road in Weekday

It is shown that the most dominating vehicle in New Marine Drive road is auto rickshaw rather than other types of vehicles both weekend and weekday and their values are 33% and 30% respectively. Auto rickshaw occupancy on road is higher because other public transports are not available on this road so that most of the people of this locality prefer auto-rickshaw to go their destination. The CNG is the second type of vehicle which governs the maximum number in this road which contains 21% on weekday. Microbus, Motorbike, and car are medium governing vehicles both in weekday and weekend. The percentage of the motorbike is double in the weekend than weekday because people of the surrounding area come to see the beauty of the Bay of Bengal on the weekend day via motorbike. The presence of trucks, buses, and NMT in this road is less amount compared to other types of vehicles because public buses, heavy trucks are not allowed to travel through this road and maximum people travel by rickshaw and CNG (Figure 4-1 & Figure 4-2).

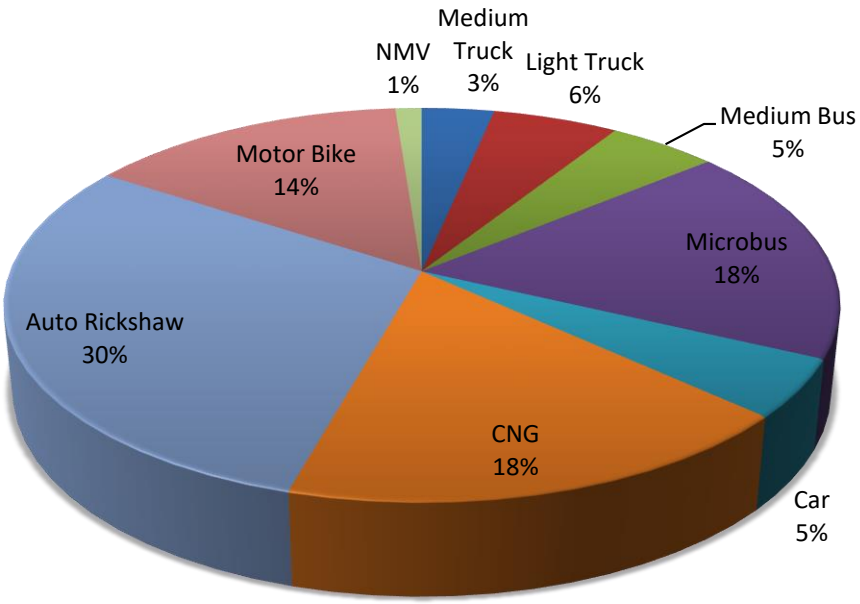


Figure 4-2: Vehicle Compositions of New Marine Drive Road in Weekend

Old Marine Drive Road:

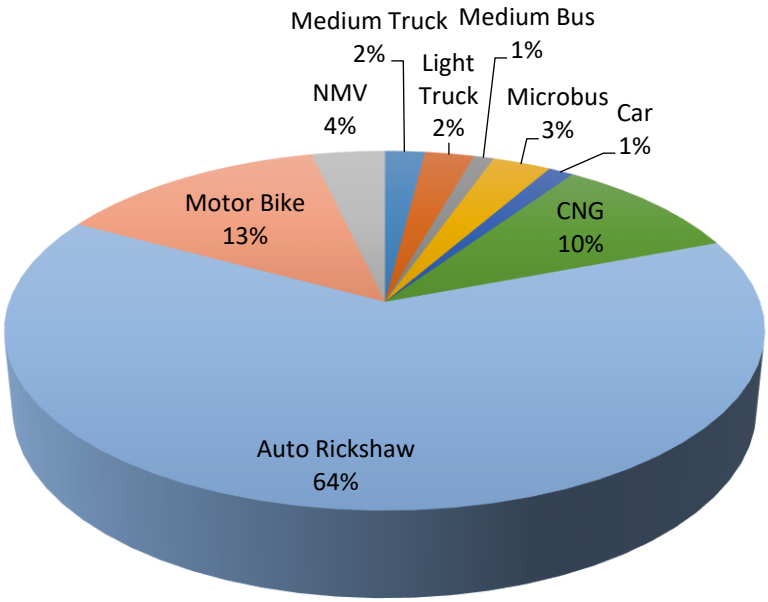


Figure 4-3: Vehicle Compositions of Old Marine Drive Road in Weekday

The study has discovered that the most influencing vehicle is auto-rickshaw in the Old Marine Drive road at weekday and weekend and their values are 64% and 69% respectively. This road also called Parjatan Bazar road and this road mainly passes through rural area, and public transports (Bus, laguna, etc) are not available to travel to facilitate most of the people surrounding this road use auto rickshaw to travel their destination. From the survey, it is seen that motorbike

and CNG are the moderate dominating vehicle both in weekday and weekday. However truck, microbus, car, and NMT are not significant in this road. This road contains the minimal volume of traffic compares to other two roads of our study area because of new connecting road of Teknaf-Cox's Bazar road to Marine Drive road (Figure 4-3 & Figure 4-4).

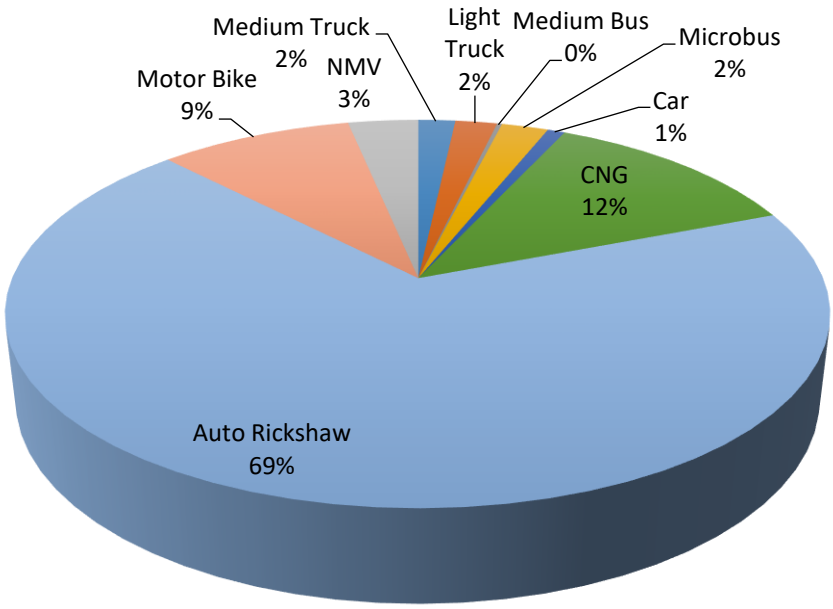


Figure 4-4: Vehicle Compositions of Old Marine Drive Road in Weekend

Teknaf-Cox's Bazar Road:

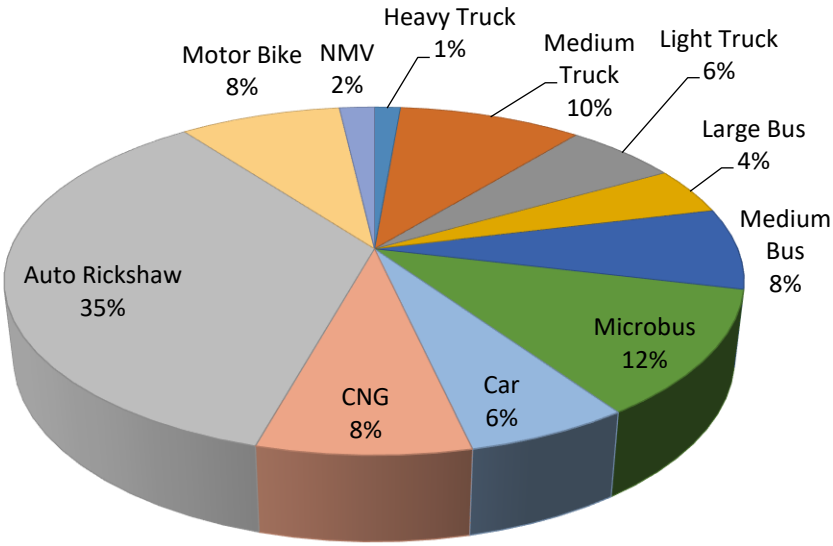


Figure 4-5: Vehicle Compositions of Teknaf – Cox's Bazar Road in Weekend

This road connects Teknaf with Cox's Bazar, Chittagong, and Dhaka directly. In this road, the most dominant vehicle in weekday and weekend is auto rickshaw which contains 45% and 35% respectively. The next influencing vehicle in this road is CNG in weekday which contains 13% and Microbus in weekend which contains 12% of the total traffic. Car, motorbike, and medium truck are the medium dominating vehicle. Several percentages of bus travel through this road

because this is the only road to travel Dhaka, Chittagong, and other parts of Bangladesh from Teknaf by bus. Heavy truck contains almost 0% on weekdays and 1% in weekends because Teknaf is a tourist area and there is no industry (Figure 4-5 & Figure 4-6).

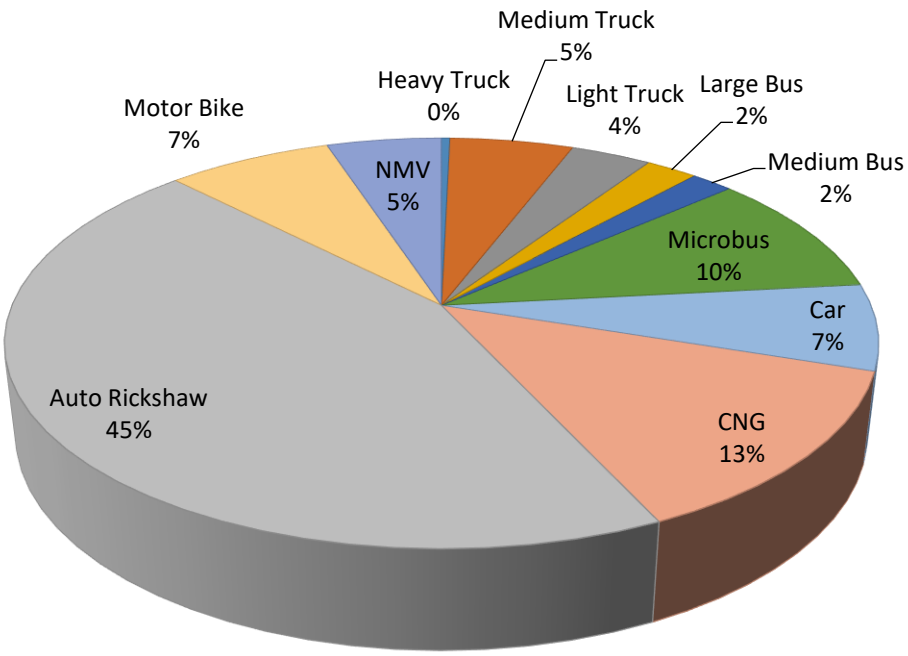


Figure 4-6: Vehicle Compositions of Teknaf – Cox's Bazar Road in Weekday

4.1.3 Total Vehicle Composition

It is seen that the auto-rickshaw contains the maximum percentage and its amount is 42%. It means that the majority number of people travel by auto-rickshaw to reach their destination. Auto Rickshaw is the most available vehicle in the study area because of the absence of other public transports. The second dominating vehicle is CNG which contains 13% of total traffic. It is seen that auto-rickshaw and CNG contain 55% of the total traffic of the study area. Teknaf is a rural area that's why the volume of three-wheeler is a significant amount. The next influencing vehicles are microbus, motorbike, and car, and their amount is 11%, 9%, and 6% respectively. Medium trucks and light trucks are available in the moderate range and they combinedly contain 9% of total vehicles. The percentage of NMV is only 3% of the total vehicle. It means people of this area do not prefer to travel by NMV. Medium bus and large bus contains 4% and 2% respectively. Its percentage will increase during the winter season because tourists from different parts of the country come to Teknaf by bus. The heavy truck contains less percentage of all traffic because this is not an industrialized area (Figure 4-7).

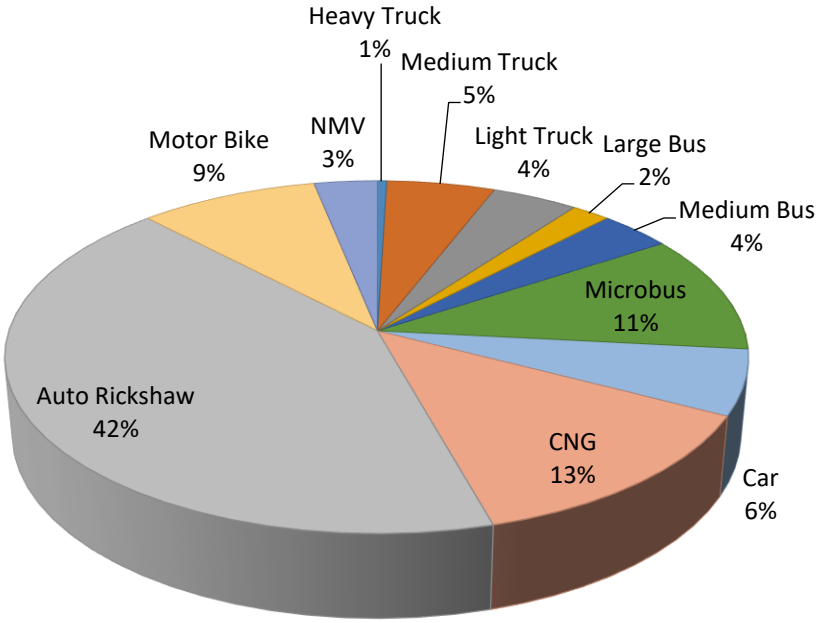


Figure 4-7: Total Vehicle Composting of Study Area

4.1.4 Level of Services (LOS) Analysis

Table 4-2: Level of services of New Marine Drive Road by volume capacity ratio method

Time	S (pcu/hr/ln)	N (ln)	g (sec)	C (sec)	Capacity, c (pcu/hr)	Volume, v (pcu/hr)	v/c	LOS
Weekday Morning	1800	2	18	65	997	124	0.12	A
Weekend Morning	1800	2	18	65	997	118	0.12	A
Weekday Afternoon	1800	2	22	65	1218	224	0.18	A
Weekend Afternoon	1800	2	22	65	1218	212	0.17	A
Weekday Evening	1800	2	25	65	1384	238	0.17	A
Weekend Evening	1800	2	25	65	1384	312	0.23	A

Analysis expressed that in New Marine Drive Road traffic capacity is more than its traffic volume in three periods of time. All of the lanes in this approach accomplish the level of service of A category on weekends and weekdays. In Marine drive road speed of the vehicle is satisfactory during all three peak hours. That's why most of the people use this road to go Cox's Bazar rather than Teknaf- Cox's Bazar Road (Table 4-2).

Table 4-3: Level of services of Old Marine Drive Road by volume capacity ratio method

Time	S (pcu/hr/ln)	N (ln)	g (sec)	C (sec)	Capacity, c (pcu/hr)	Volume, v (pcu/hr)	v/c	LOS
Weekday Morning	1200	2	16	58	662	130	0.20	A
Weekend Morning	1200	2	16	58	662	104	0.16	A
Weekday Afternoon	1200	2	19	58	786	172	0.22	A
Weekend Afternoon	1200	2	19	58	786	146	0.19	A
Weekday Evening	1200	2	23	58	952	204	0.21	A
Weekend Evening	1200	2	23	58	952	156	0.16	A

By comparing the given v/c ration and standard v/c ratio, it is seen that LOS is A category at weekday and weekend day peak time. The result indicates that the existing conditions of Old Marine Drive Road are satisfactory both in weekday and weekend. The major problem is that we collect data during Covid-19 situations, maybe the reason for less volume of present traffic (Table 4-3).

Table 4-4: Level of services of Teknaf- Cox's Bazar Road by volume capacity ratio method

Time	S (pcu/hr/ln)	N (ln)	g (sec)	C (sec)	Capacity, c (pcu/hr)	Volume, v (pcu/hr)	v/c	LOS
Weekday Morning	1800	2	26	85	1101	702	0.64	C
Weekend Morning	1800	2	26	85	1101	564	0.51	B

Weekday Afternoon	1800	2	24	85	1016	622	0.61	C
Weekend Afternoon	1800	2	24	85	1016	530	0.52	B
Weekday Evening	1800	2	35	85	1482	840	0.57	B
Weekend Evening	1800	2	35	85	1482	682	0.46	B

According to the volume capacity ratio (v/c) method level of service (LOS) of Teknaf- Cox's Bazar Road is B category at weekend morning, afternoon, and evening peak time, LOS is C category at weekday morning and afternoon peak time. This result indicating the level of service is the medium range in this road. From the analysis, it is seen that speed of the vehicle in Teknaf- Cox's Bazar Road is slightly lower than the other two roads. It is shown that from analysis traffic volume is less than its capacity in three periods of time. Teknaf has a more attractive tourist place but tourists are not interested to travel here because of the existing conditions of this road and infrastructure facilities, so existing conditions of Teknaf- Cox's Bazar road should increase to attract tourist to travel in Teknaf (Table 4-4).

4.1.5 Average Annual Daily Traffic (AADT) Analysis

Table 4-5: Average Annual Daily Traffic (AADT) of New Marine Drive Road

Point Name	Motorized Vehicle	Non-Motorized Vehicle
Teknaf Beach	3138	53
`Total 24 hour volume (pcu/day)	3191	
DEF	6.530	
Total 7- day volume (pcu/week)	20837	
ADT (pcu/day)	2977	
MEF	0.884	
AADT (pcu/day)	2632	

Average Annual Daily Traffic (AADT) volume of New Marine Drive Road, Old Marine Drive Road, and Teknaf- Cox's Bazar Road are 2632 pcu/day, 1551 pcu/day, and 7819 pcu/day respectively. The result indicates that traffic volume is less in Old Marine Drive Road and traffic volume is

higher in Teknaf- Cox's Bazar Road. Teknaf- Cox's Bazar Road is the only road to travel to Teknaf from different parts of the country directly, also transporting goods this road is only available. Even though an alternative road (Marine drive road) has been constructed connecting between Cox's Bazar to Teknaf but there is a restriction for various vehicles to use this road. For this reason, AADT of Teknaf- Cox's Bazar Road is higher. This value will increase more in the future when Naf Tourism Park will open for public (Table 4-5, Table 4-6, Table 4-7).

Table 4-6: Average Annual Daily Traffic (AADT) of Old Marine Drive Road

Point Name	Motorized Vehicle	Non-Motorized Vehicle
Parjatan Bazar	1840	40
`Total 24 hour volume (pcu/day)	1880	
DEF	6.530	
Total 7- day volume (pcu/week)	12276	
ADT (pcu/day)	1754	
MEF	0.884	
AADT (pcu/day)	1551	

Table 4-7: Average Annual Daily Traffic (AADT) of Teknaf- Cox's Bazar Road

Point Name	Motorized Vehicle	Non-Motorized Vehicle
Teknaf Bus Stand	9000	482
Total 24 hour volume (pcu/day)	9482	
DEF	6.530	
Total 7- day volume (pcu/week)	61917	
ADT (pcu/day)	8845	
MEF	0.884	
AADT	7819	

(pcu/day)	

4.2 Trip Generation and Trip Distribution Analysis

Trip generation is the process of estimating the number of trips that will begin or end in each zone within a study area. Trip generation is performed by relating the number or frequency of trips to the characteristics of the individuals, of the zone, and of the transportation network. The goal of trip generation is to predict the number of trips, which are generated and attracted to each zone in a study area. The maximum trip is generated in Teknaf Town Area compare to the other two areas. Trip distribution is the process by which all trips generated in a study area are allocated among zones. Almost 45% trip distributed in Teknaf Town Area. This is the main point of Teknaf and people of all classes use this point as origin and destination. For this reason result of trip generation and trip, distribution is more in Teknaf Town Area (Table 4-8).

Table 4-8: Trip Generation and Trip Distribution Values of Different Points

Point Name	Trip Generation	Trip Distribution (%)
Teknaf Town Area	153	43.72
Teknaf Beach Point Area	102	29.14
Parjatan Bazar Area	95	27.14

4.3 Speed and Delay Analysis

New Marine Drive Road:

The results show that maximum free-flow speed is 69.30 Km/hr for motorbike in New Marine Drive Road. From results all motorized vehicles minimum free flow speed occurred for auto rickshaw during all three periods and non-motorized vehicles minimum free flow speed occurred for push vehicles. Total average delay time is less at night because at night drivers are not influenced by adverse effects of road. It is seen that average highest delay occurred in evening time because volume of traffic increase at evening because people of this area like to spend their leisure time in the sore of the sea beach specially evening and night time (Table 4-9).

Table 4-9: Speed and Delay Values of New Marine Drive Road

	Morning			Evening			Night		
Veh. Type	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)
Heavy Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Medium Truck	42.10	27.43	1.02	42.10	26.20	1.15	42.10	32.45	0.57
Light Truck	38.80	26.65	0.94	38.80	25.85	1.03	38.80	31.67	0.46
Large Bus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Bus	46.10	30.45	0.89	46.10	29.43	0.98	46.10	33.75	0.64
Microbus	54.30	35.78	0.76	54.30	33.67	0.90	54.30	38.54	0.60
Car	54.30	37.76	0.65	54.30	34.97	0.81	54.30	39.87	0.53
CNG	21.95	18.49	0.68	21.95	17.42	0.95	21.95	19.45	0.47
Auto Rickshaw	18.70	15.89	0.76	18.70	15.25	0.97	18.70	16.90	0.46
Motor Bike	69.30	53.82	0.33	69.30	50.65	0.43	69.30	55.20	0.29
Bicycle	9.10	8.50	0.62	9.10	8.25	0.91	9.10	8.65	0.46
Rickshaw	7.00	6.45	0.97	6.60	6.40	1.07	6.60	6.57	0.75
Van	7.00	6.54	0.80	7.00	6.45	0.97	7.00	6.50	0.88
Animal /push	4.00	3.65	1.92	4.00	3.50	2.86	4.00	3.80	1.05

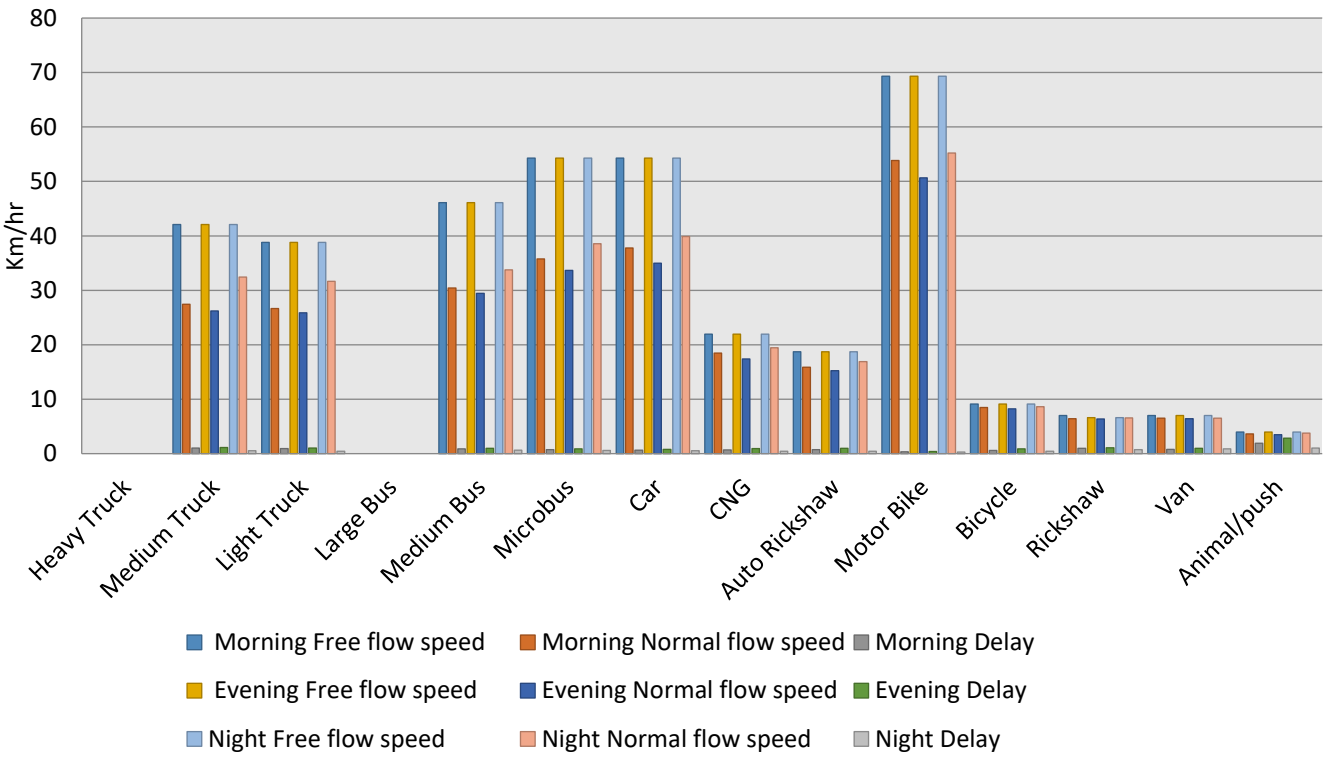


Figure 4-8: Variation of Speed and Delay at New Marine Drive Road

Old Marine Drive Road:

Table 4-10: Speed and Delay Values of Old Marine Drive Road

	Morning			Evening			Night		
Veh. Type	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)
Heavy Truck	10.00	6.84	0.65	10.00	6.21	0.85	10.00	8.12	0.32
Medium Truck	12.56	8.65	0.50	12.56	8.45	0.54	12.56	9.87	0.30
Light Truck	15.50	10.37	0.45	15.50	9.64	0.55	15.50	11.97	0.27

Large Bus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Bus	27.00	15.40	0.39	27.00	14.86	0.42	27.00	18.65	0.23
Microbus	34.50	20.31	0.28	34.50	19.28	0.32	34.50	25.29	0.15
Car	34.10	22.89	0.20	34.10	22.65	0.21	34.10	26.39	0.12
CNG	24.00	15.43	0.32	24.00	13.76	0.43	24.00	18.18	0.19
Auto Rickshaw	12.50	8.21	0.59	12.50	7.42	0.77	12.50	9.79	0.31
Motor Bike	28.20	21.37	0.16	28.20	20.28	0.19	28.20	22.57	0.12
Bicycle	7.50	6.45	0.30	7.50	5.93	0.49	7.50	6.73	0.21
Rickshaw	6.50	5.34	0.47	6.50	4.89	0.71	6.50	5.85	0.24
Van	6.80	4.92	0.79	6.80	4.74	0.89	6.80	5.32	0.57
Animal/ push	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

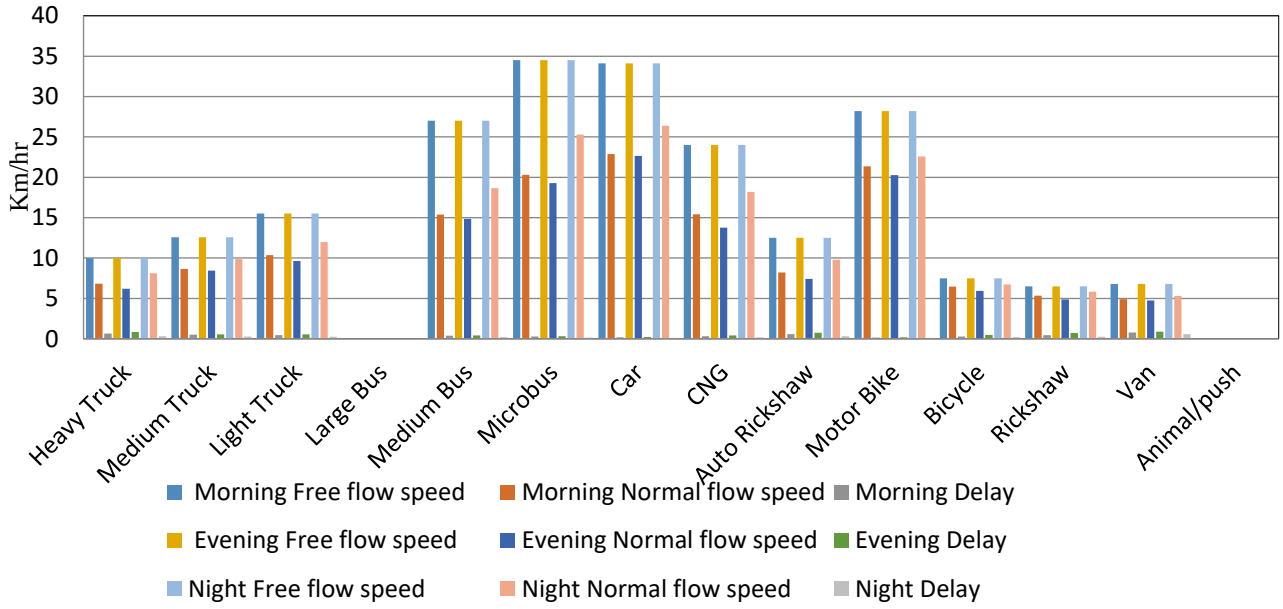


Figure 4-9: Variation of Speed and Delay at Old Marine Drive Road

The highest free-flow speed has been occurred 34.50 Km/hr in Old Marine Drive Road. This road is an urban road and conditions of existing road condition is medium that's why free flow speed is less than Marine drive road. Average delay time minimum at night and maximum in the evening. The average delay time in the evening is high because in the evening the number of working and non-working trips increased (Table 4-10).

Teknaf- Cox's Bazar Road:

Table 4-11: Speed and Delay Values of Teknaf- Cox's Bazar Road

	Morning			Evening			Night		
Veh. Type	Free flow speed (Km/hr)	Normal flow (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)	Free flow speed (Km/hr)	Normal flow speed (Km/hr)	Delay (hr)
Heavy Truck	20.00	13.2	2.24	20.00	11.87	2.98	20.00	15.42	1.29
Medium Truck	30.00	18.45	1.82	30.00	17.34	2.12	30.00	21.43	1.16

Light Truck	28.00	19.34	1.39	28.00	18.21	1.67	28.00	24.52	0.44
Large Bus	36.30	20.54	1.84	36.30	19.65	2.03	36.30	23.44	1.31
Medium Bus	29.00	17.76	1.90	29.00	15.89	2.48	29.00	25.76	0.38
Microbus	32.40	22.76	1.14	32.40	20.78	1.50	32.40	27.76	0.45
Car	32.40	23.21	1.06	32.40	21.53	1.36	32.40	28.83	0.33
CNG	19.00	14.59	1.38	19.00	12.72	2.26	19.00	15.60	1.00
Auto Rickshaw	16.00	10.90	2.54	16.00	9.98	3.28	16.00	13.90	0.82
Motor Bike	45.00	30.27	0.94	45.00	28.61	1.11	45.00	34.84	0.56
Bicycle	6.30	5.45	2.15	6.30	5.20	2.92	6.30	6.00	0.69
Rickshaw	7.55	6.14	2.65	7.55	5.96	3.07	7.55	6.80	1.27
Van	6.80	5.27	3.71	6.80	5.00	4.61	6.80	6.10	1.47
Animal/ push	3.00	2.55	5.12	3.00	2.42	6.95	3.00	2.75	2.64

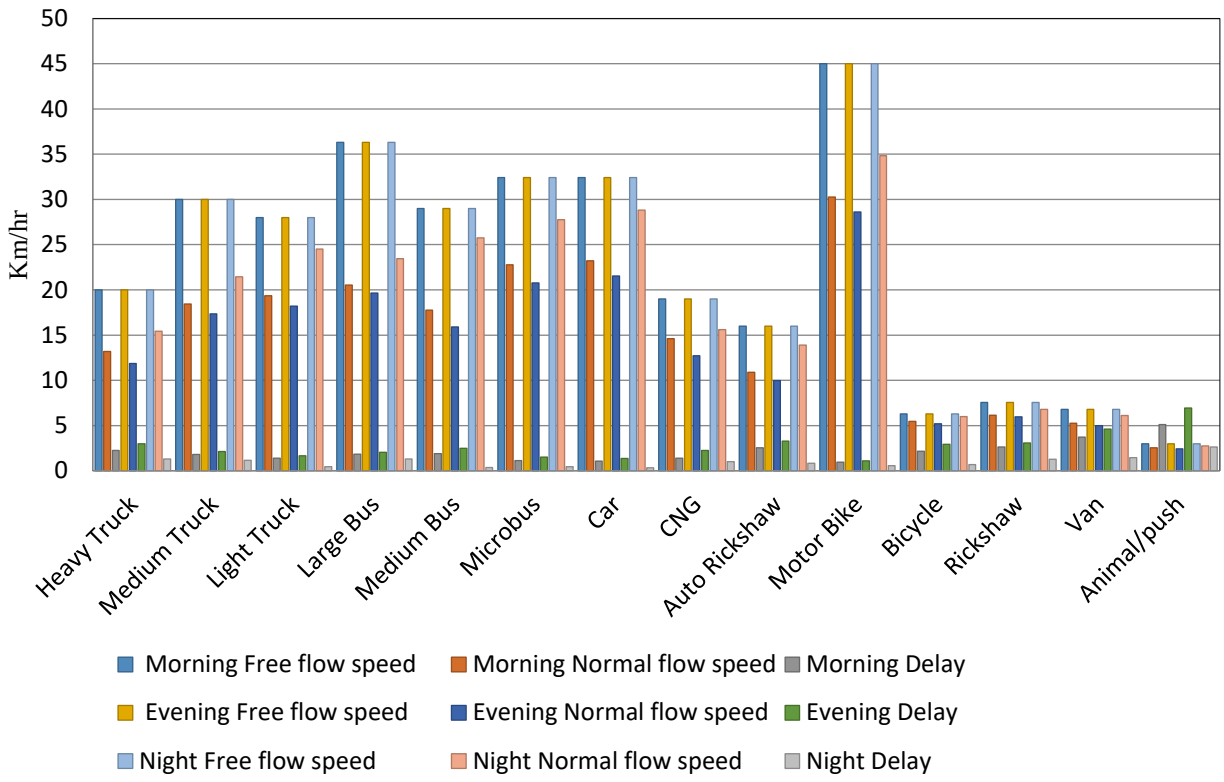


Figure 4-10: Variation of Speed and Delay at Teknaf- Cox's Bazar Road

Teknaf- Cox's Bazar Road is the main road of travel heavy and light vehicles from different parts of the country directly to Teknaf. The highest free-flow speed has been occurred 45 Km/hr only for motorbike. The average delay time is more all three periods of time compared to the other two roads of the study area. The total average delay time is high because existing conditions of the road are in poor category and drivers are influenced by adverse effects of the road. Travel time from Teknaf to Cox's Bazar via Marine drive road required 1-2 hour less time than this road. So existing conditions should be improved to attract people use this road (Table 4-11).

4.4 Future Traffic Volume Analysis

Future traffic volume of the study area mainly increases due to connections to recreation or tourist activities, Population projections for the areas served by the road, anticipated growth of cities, anticipated growth of business traffic on the road. Volume and capacity is a measure that reflects the mobility and quality of travel of a facility or a section of a facility. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). From the results the volume of future traffic less than its capacity for the next 20 years of New Marine Drive road, but after 20 years it's capacity so the capacity of the road needs to be increased. The present traffic capacity of Old Marine Drive Road is acceptable but after 20 years traffic volume will increase more than its capacity. In Teknaf- Cox's Bazar road capacity is sufficient up to 2030, but after that traffic volume exceeds is capacity, and conditions of this road become worst because of high future traffic volume. Here it is seen that the volume of traffic is less in all three roads, this because of the COVID-19 situation and a recent incident in the Teknaf area. So it should be noted that after Covid-19 traffic volume increased more. So local Governing authority of this area should take proper steps to increase its capacity to provide convenient travel of local people and tourist (Table 4-12).

Table 4-12: Future Traffic Volume of Study area

Point Name	Present Volume (pcu/yr)	Future Volume (pcu/yr)						Capacity (pcu/yr)
		2025	2030	2035	2040	2045	2050	
New Marine Drive Road	1104782	1779262	2865520	4614949	7432421	11969988	19277786	10512000
Old Marine Drive Road	651032	1048494	1688610	2719523	4379819	7053743	11360124	7008000
Teknaf-Cox's Bazar Road	3282025	5285734	8512728	13709834	22079825	35559778	57269379	10950000

4.5 Pedestrian Level of Services

Teknaf Bus Stand Point:

The analysis shows that the pedestrian level of services is in the A category at 7 am-8 am at this point. In the morning pedestrian flow rate is high at 9 am-10 am and its value is 14 ped/min/ft because people of different professions use this time to reach their target point. In the afternoon pedestrian flow rate is more at 1 pm-2 pm. The average pedestrian flow rate is high in evening and 6 pm-7 pm time contains the maximum flow rate with a value of 16 ped/min/ft. Working people go home and most of the non-working people go outside of the home at evening that's why the pedestrian flow rate is more at this time (Table 4-13).

Table 4-13: Level of Services of Pedestrian at Tekanf Bus Stand Point

Time	Pedestrian Flow Rate (ped/min/ft)	LOS

7am-8am	2	A
8am-9am	6	B
9am-10am	14	D
10am-11am	8	C
11am-12pm	6	B
12pm-1pm	11	D
1pm-2pm	13	D
2pm-3pm	9	C
3pm-4pm	5	B
4pm-5pm	9	C
5pm-6pm	12	D
6pm-7pm	16	E

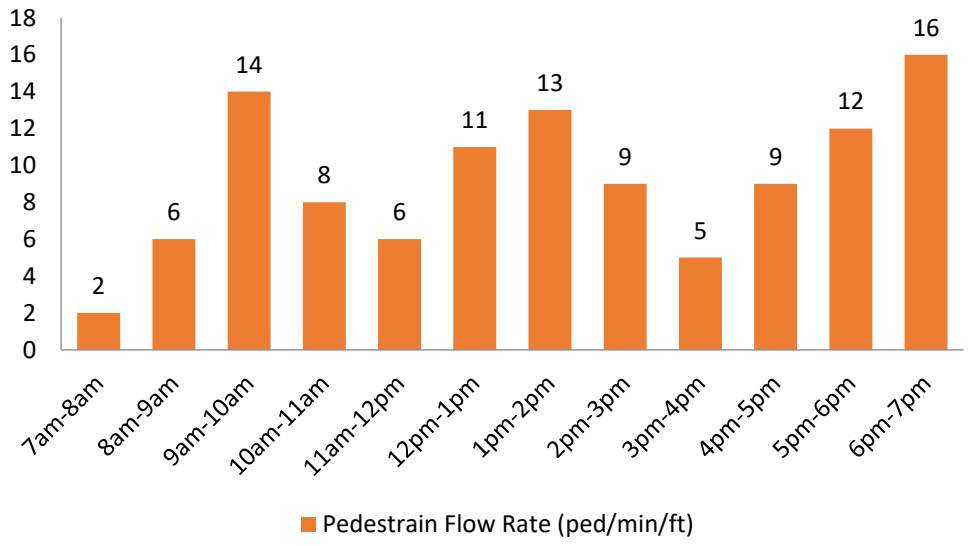


Figure 4-11: Variation of pedestrian Flow Rate at Teknaf Bus Stand Point

Teknaf Beach Point:

Table 4-14: Level of Services of Pedestrian at Tekanf Beach Point

Time	Pedestrian Flow Rate (ped/min/ft)	LOS
7am-8am	1	A
8am-9am	2	A
9am-10am	5	B

10am-11am	3	A
11am-12pm	2	A
12pm-1pm	4	A
1pm-2pm	3	A
2pm-3pm	1	A
3pm-4pm	6	B
4pm-5pm	9	C
5pm-6pm	10	D
6pm-7pm	8	C

The average level of services (LOS) of the pedestrian is in the A category in morning in Teknaf beach point. The pedestrian flow rate is highest at 5 pm-6 pm and its value is 10 ped/min/ft. The average level of services accomplish C category in the evening because people of all classes come to this point for their refreshment in the evening (Table 4-14).

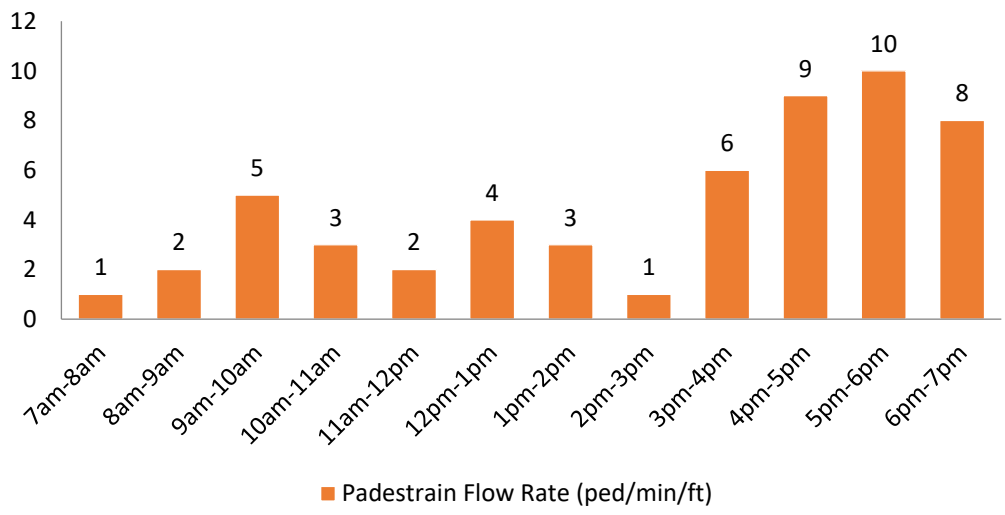


Figure 4-12: Variation of pedestrian Flow Rate at Teknaf Beach Point

Parjatan Bazar Point:

Results show that the pedestrian flow rate is less in very morning time. Highest flow rate is 11 ped/min/ft at 1pm-2pm and 5pm-6pm (Figure 4-15).

Table 4-15: Level of Services of Pedestrian at Parjatan Bazar Point

Time	Pedestrian Flow Rate (ped/min/ft)	LOS
7am-8am	1	A
8am-9am	3	A
9am-10am	6	B

10am-11am	8	C
11am-12pm	5	B
12pm-1pm	9	C
1pm-2pm	11	D
2pm-3pm	6	B
3pm-4pm	4	A
4pm-5pm	5	B
5pm-6pm	11	D
6pm-7pm	8	C

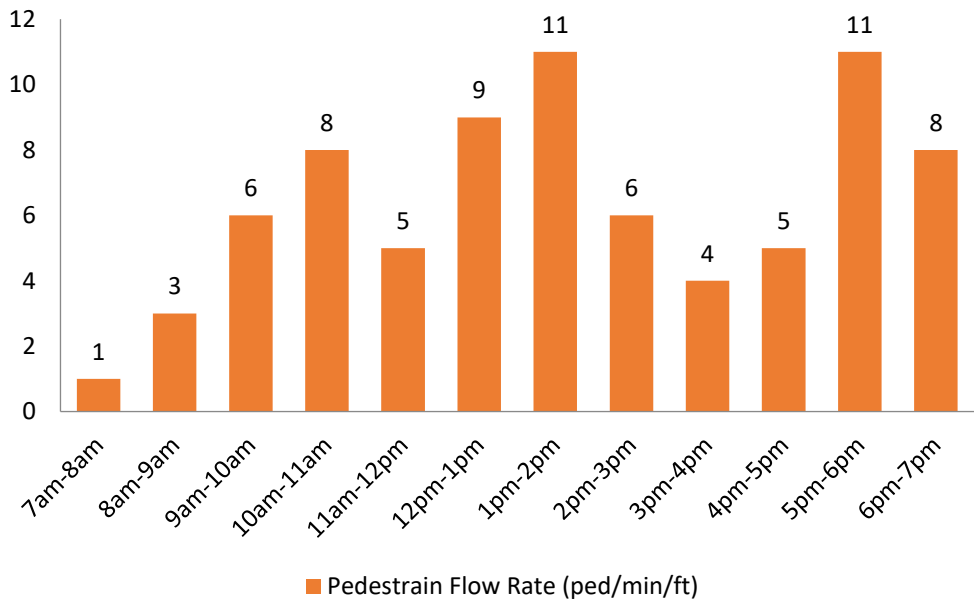


Figure 4-13: Variation of pedestrian Flow Rate at Parjatan Bazar Point

4.6 Willing to Pay Analysis

Gender:

In terms of gender most of the respondents are male (77%) compare with the female (23%). The gender data indicate that female responses are like to stay home and male numbers are comparatively high in different road uses. Personal interviews reveal that female people feel discomfort to go outside because of safety issues (Figure 4-14).

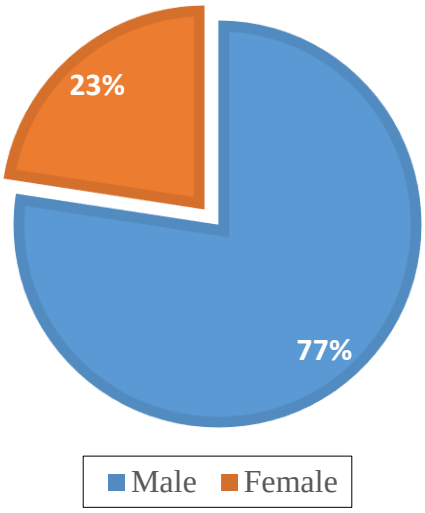


Figure 4-14: Respondent's gender ratio

Age:

The majority of peoples in this study are 20 to 40 years age range. This indicates young and old or disabled people are the less user of the prospective road. Because the road is very busy and there have no facilities for older and disabled people (Figure 4-15).

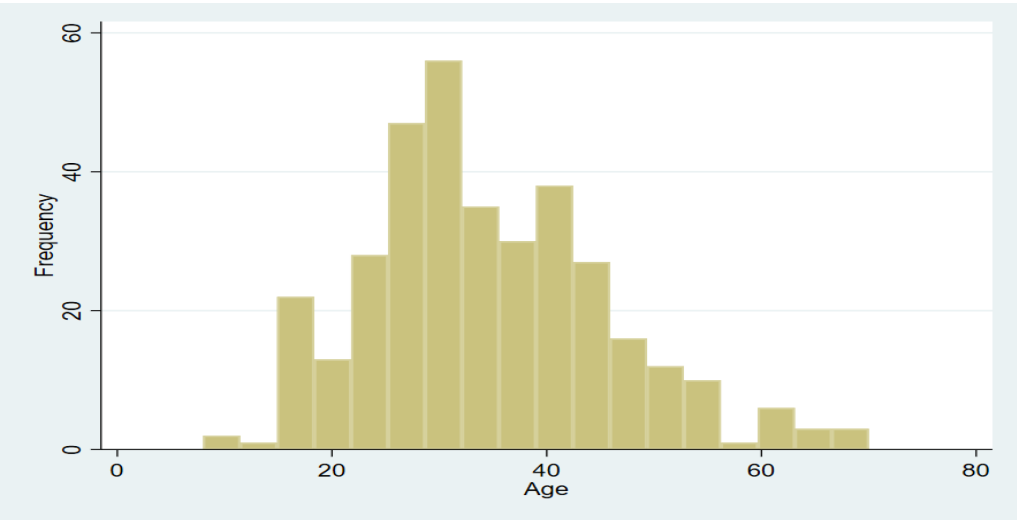


Figure 4-15: Age distribution of the respondents

Education:

Only 3.143% people in the respondent are illiterate. This indicates that the majority of people in the area are literate because lots of tourist-related jobs are available in the locality. For communicating with tourists it is crying need to have basic education through the education facility in this area are quite low. 36% people in the respondent have secondary education and 29.14% respondents have primary education. The higher educated person is 31.71% where most of the people from outside of the Teknaf area. Personal interviews reveal that they are the service holder in different offices and NGOs (Figure 4-16).

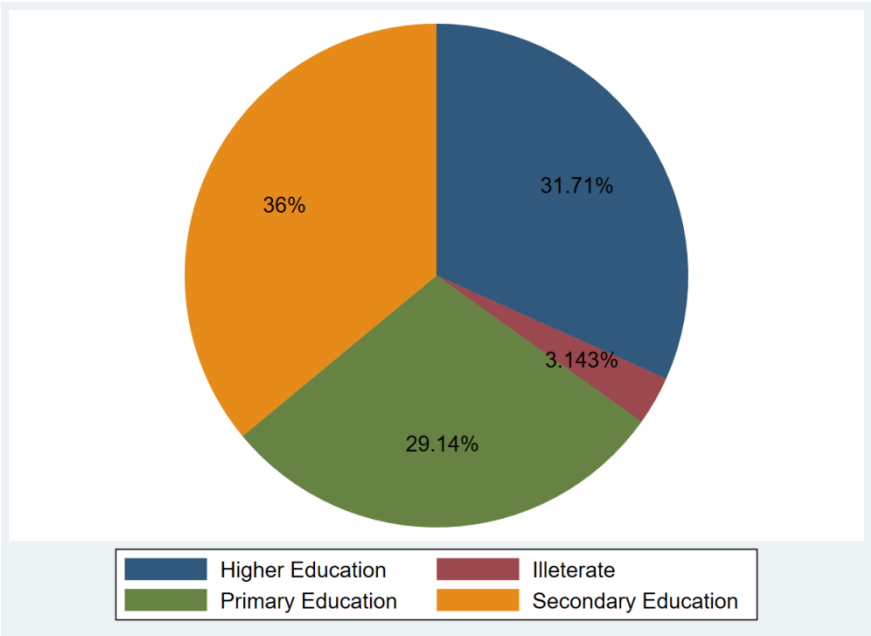


Figure 4-16: Respondent education qualification

Occupation:

31.71% of respondents are service-holder which indicates the job opportunity in the locality. Most of the people in the locality are related to different non-government jobs. Businessman (13.14%) of the respondent indicates business opportunity in the locality. Most of the businessmen are worked with the fish industry because the huge sea beach area in the locality makes the area business-friendly. However, the tourism sector is not up to mark compare with natural resources (Figure 4-17).

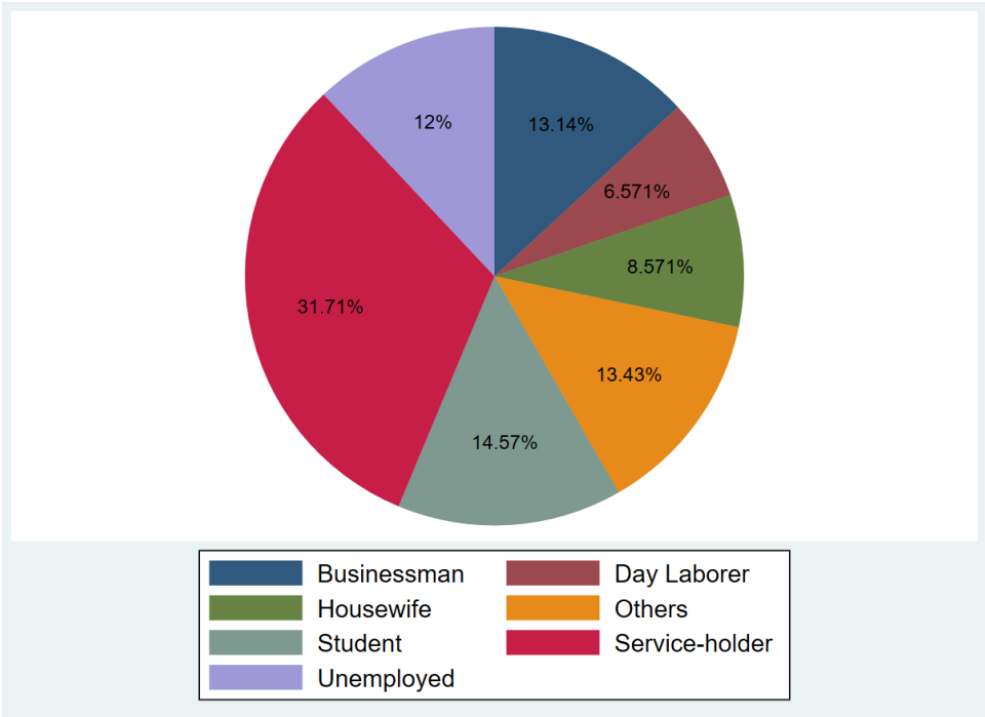


Figure 4-17: Occupation class of the responses.

Purpose of Travel:

In terms of the purpose of using roads, 24% people use the road for Home to Work purpose and 30% of respondents use the road for Home to Other purposes. It indicates working and recreational activity in the locality. However, 25% people have used the road for Work to other because they like to spend their leisure time in the sore of the sea beach especially evening and night time (Figure 4-18).

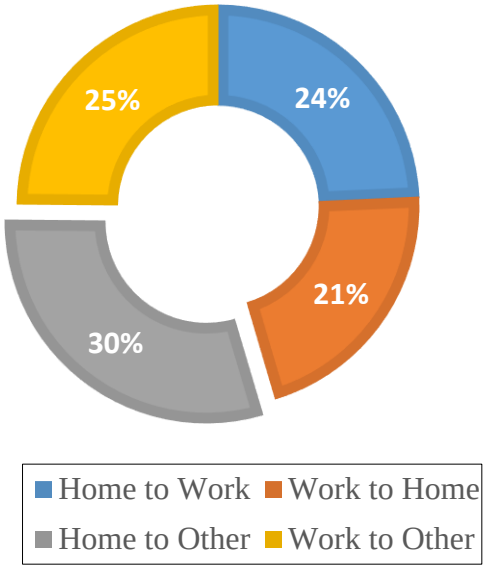


Figure 4-18: Purpose for using roads

Monthly Income:

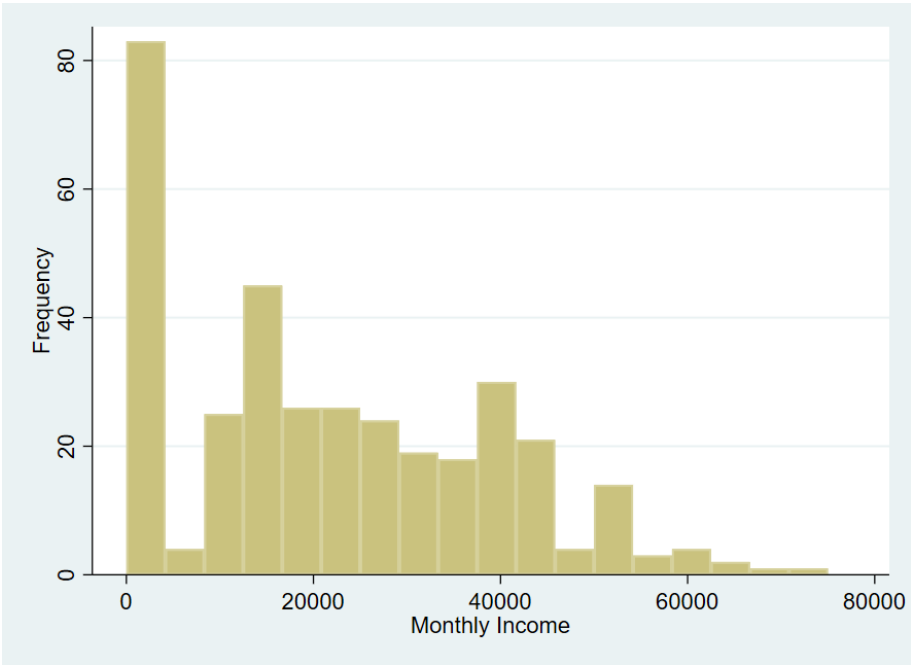


Figure 4-19: Frequency distribution of different income range respondent

In terms of monthly income, the most income range is 3,000 to 20,000 BDT. Though the place has various opportunities, but the opportunity is not explored properly. The above 40,000 BDT income group are from outside the Teknaf area who lives this place for job purpose. However, if the tourism industry will properly establish then the income range gets an increase (Figure 4-19).

Frequency of Travel:

In terms of frequency of travel in a day, about 60% people go outside 1 to 2 times. A negligible number of people go above 5 times a day, And 3 to 4 times number is approximately 22%. It indicates that most of the people try to go outside less time. Interviews reveal that the locality is very unsafe at night time and people try to avoid old and new Marin Drive roads at night time (Figure 4-20).

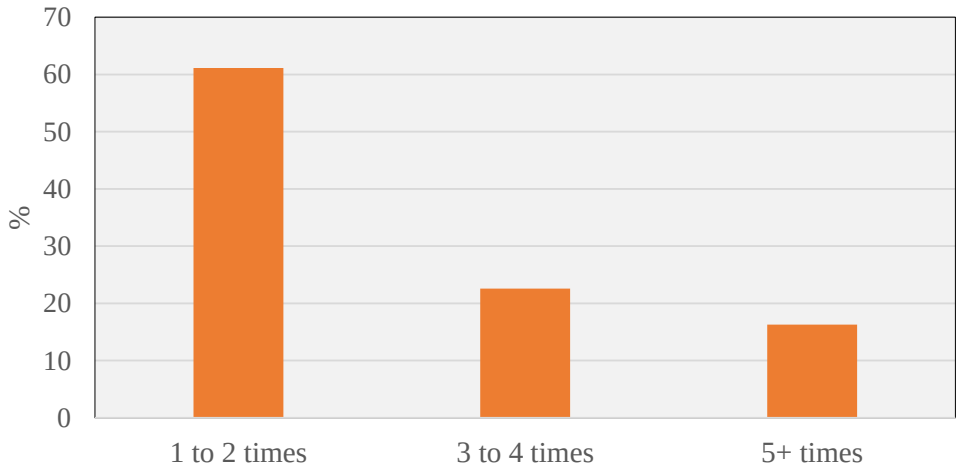


Figure 4-20: Frequency of travel in a day

Are you Tourist or Local? :

This question helps to know the number of foreign people in the locality. The results show that 18% peoples are tourists and 82% peoples are local. It indicates less number of tourist attraction though it has many natural resources. Besides the tourist number in the locality is very low compare with Cox's Bazar condition. The reason can be the poor tourist facilities or not highlighted in the media (Figure 4-21).

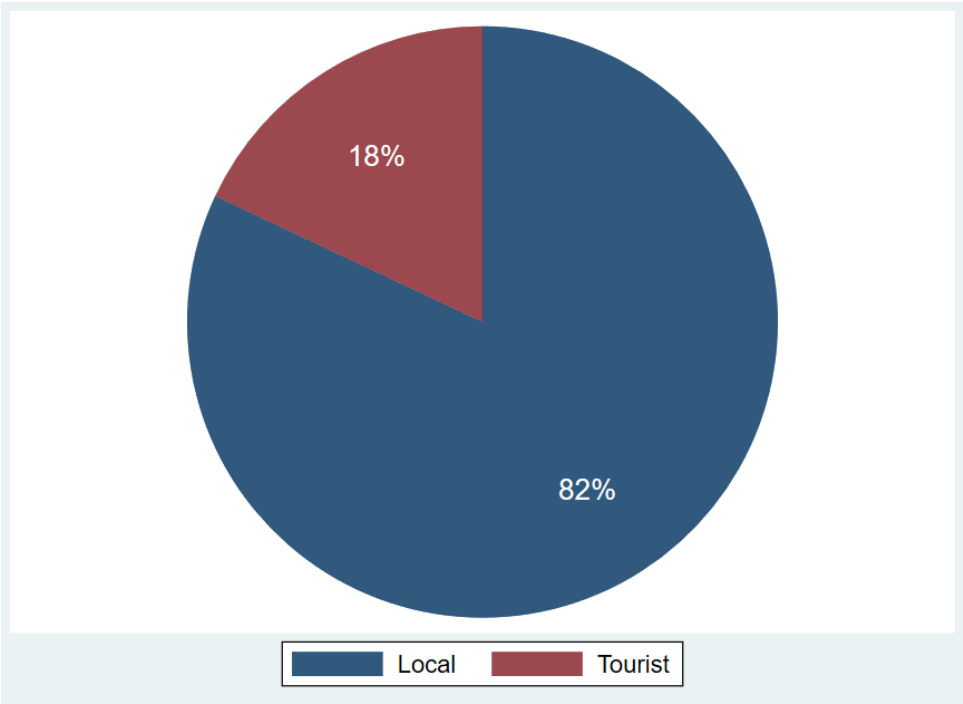


Figure 4-21: Local and tourist class percentage in Teknaf

Would you prefer propose a road or infrastructure to connect with Naf Tourism Park?:

93.71% people in the locality want entertainment and they prefer a park for that they recommend to easy access infrastructure for the park. They believe that their social-economic condition will change after the establishment of the park. Only 6.286% do not want the park in the locality which is negligible (Figure 4-22).

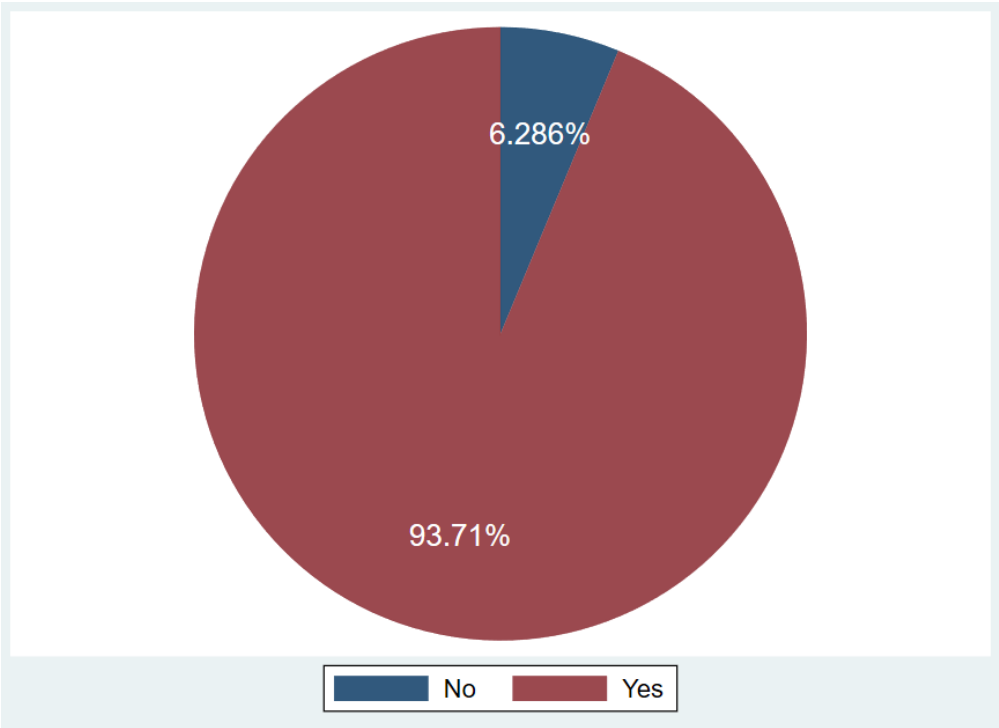


Figure 4-22: Road preference for Naf Tourism Park

Would you prefer to use the road or infrastructure?

The question illustrates the usability of the prospective road which will make it easy to access the park. About 94.86% people want to visit the park in terms of using the infrastructure facility. A Negligible number of people do not want to use the road for various reasons (Figure 4-23).

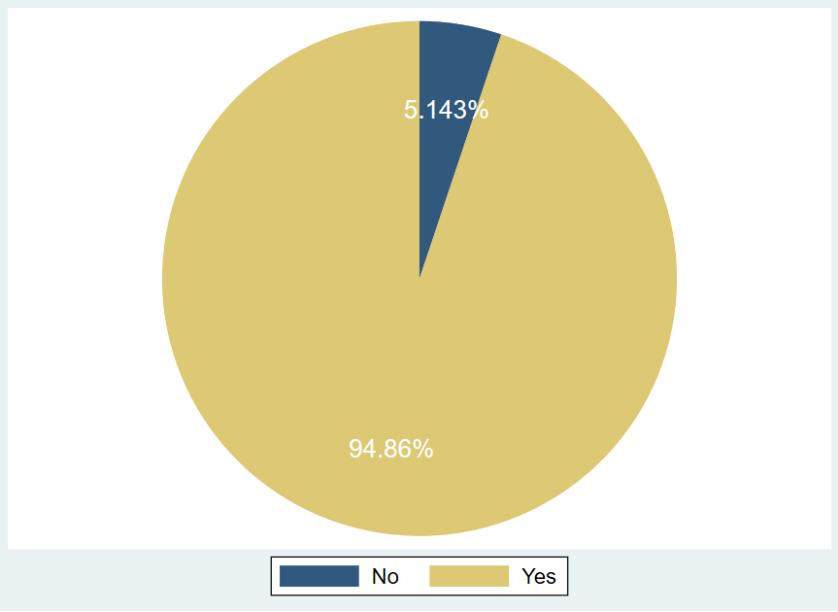


Figure 4-23: Road usability for Naf Tourism Park

Which mode do you like to prefer to use the road?

The purpose of this question is to know the mode choice to reach in Naf Tourism Park entry point. The road is Old Marin Drive road which is narrow. Most people prefer paratransit (38%) for the road because it helps to reduce various problems like traffic congestion, environmental pollution, etc. Finally, it makes the road safer. Besides, 31.43% want Bus to reach the park but personal interview reveals that they want small size Bus for this road (Figure 4-24).

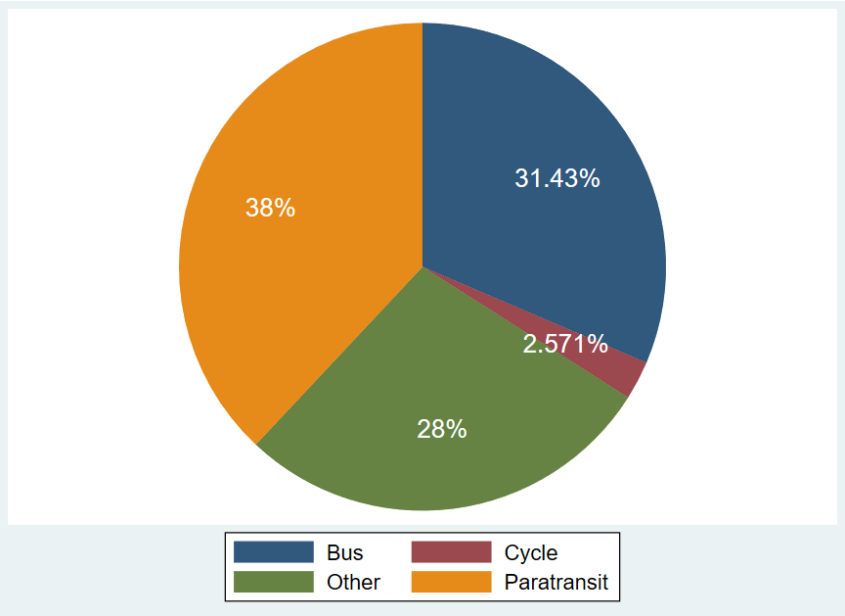


Figure 4-24: Mode preference for Naf Tourism Park

Is this road save time and money?

The park approach point is selected so that it can easily access for Teknaf town as well as from New Marin Drive Road. The survey shows that 83.71% of respondents think that, the selected road will save both time and money. Only 16.29% people think that the road is unsuitable for such kind of park. However, the majority people think that the road is perfect for the park (Figure 4-25).

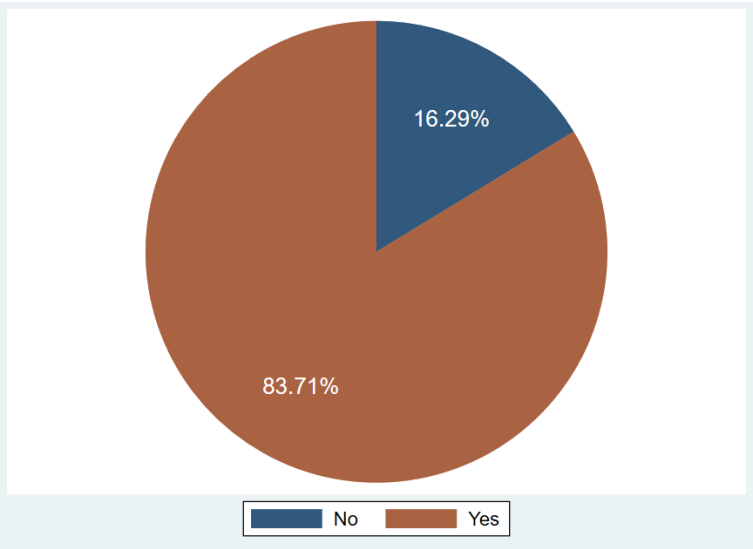


Figure 4-25: Time and money save responses

How much money will save for using this road?

About 35% people think that using the road saves 21 to 30 BDT. However the most money-saving amount is 10 to 30 BDT, special transport service can make the cost much smaller. The respondent believes that the Old Marin Drive road can be the best way to reach Naf Tourism Park (Figure 4-26).

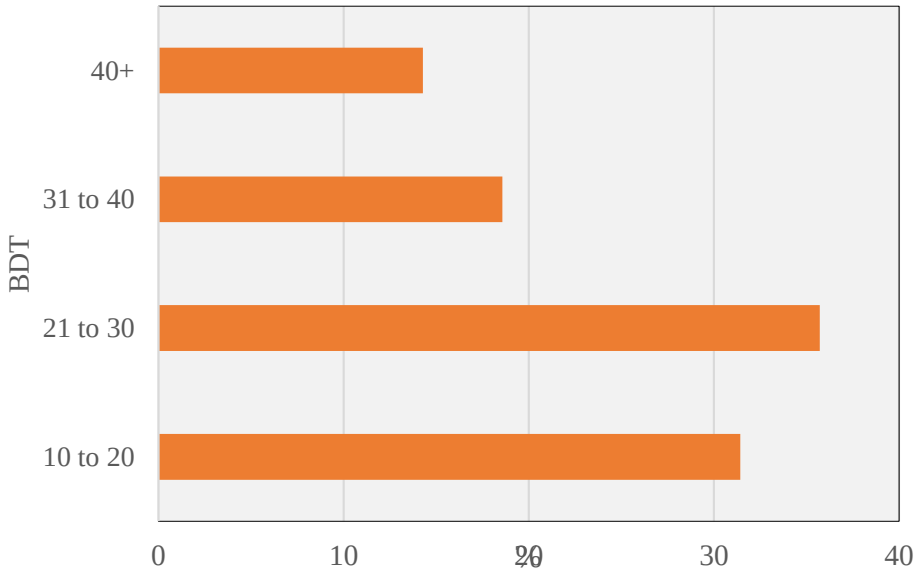


Figure 4-26: Saving amount of money

If they do not like the park then what is the reason:

This question illustrates that the park lace choice appropriateness. Only 0.5714% respondent do not like tourism. The majority say (99.43%) there have other reasons for the park. The other reason includes mismanagement or high cost to use the parking facility or high cost in transportation (Figure 4-27).

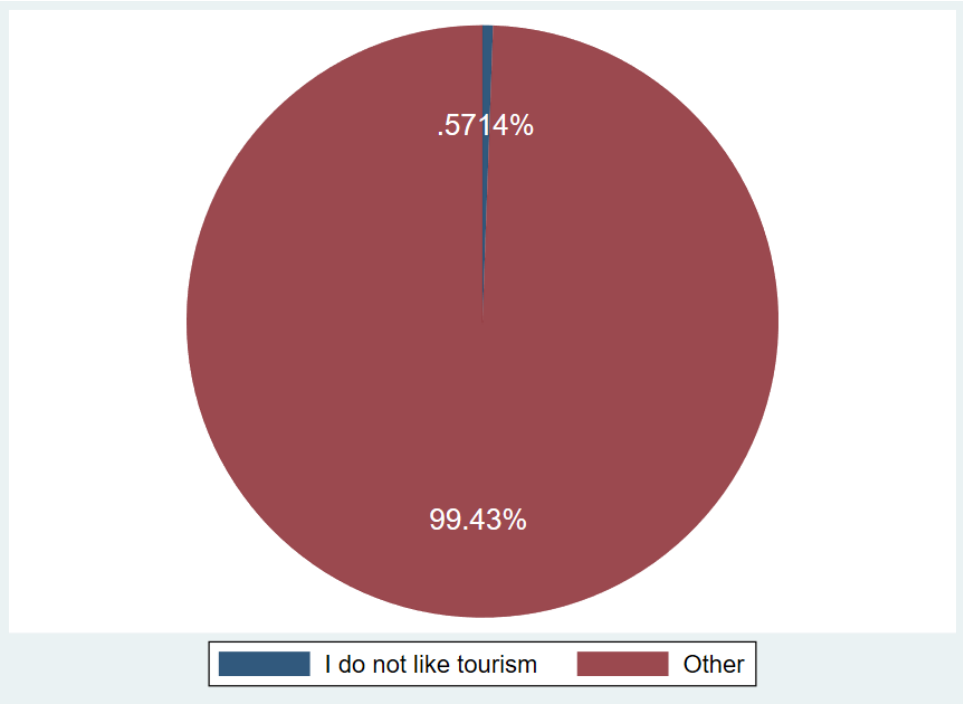


Figure 4-27: The reason for do not like the park

Road Facilities:

Respondent responses reveal that road condition is poor (53.71%). Only 1.14% people think that the existing road facilities are excellent. However, most of the roads have several geometric and non-geometric problems. The geometric problems include road width, median, curve, etc. and non-geometric facilities include traffic signals, parking facilities, information posts etc. However, the road condition is the main factor to easily access to Naf Tourism Park (Figure 4-28).

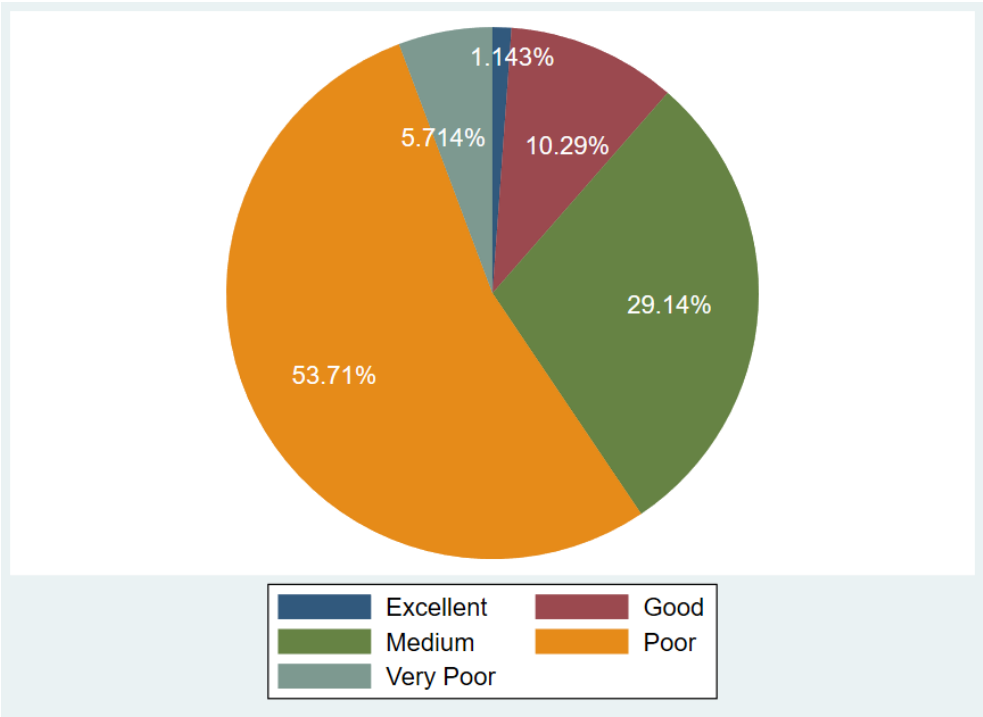


Figure 4-28: Road condition survey

Footpath Facilities:

The footpath condition is much worse than road condition most of the cases the road has no footpath facilities. 71.14% people responses the footpath facilities in poor condition. Field investigation revealed that most of the road has no footpath and people use the road as footpath which causes several road accidents and reduce carriageway (Figure 4-29).

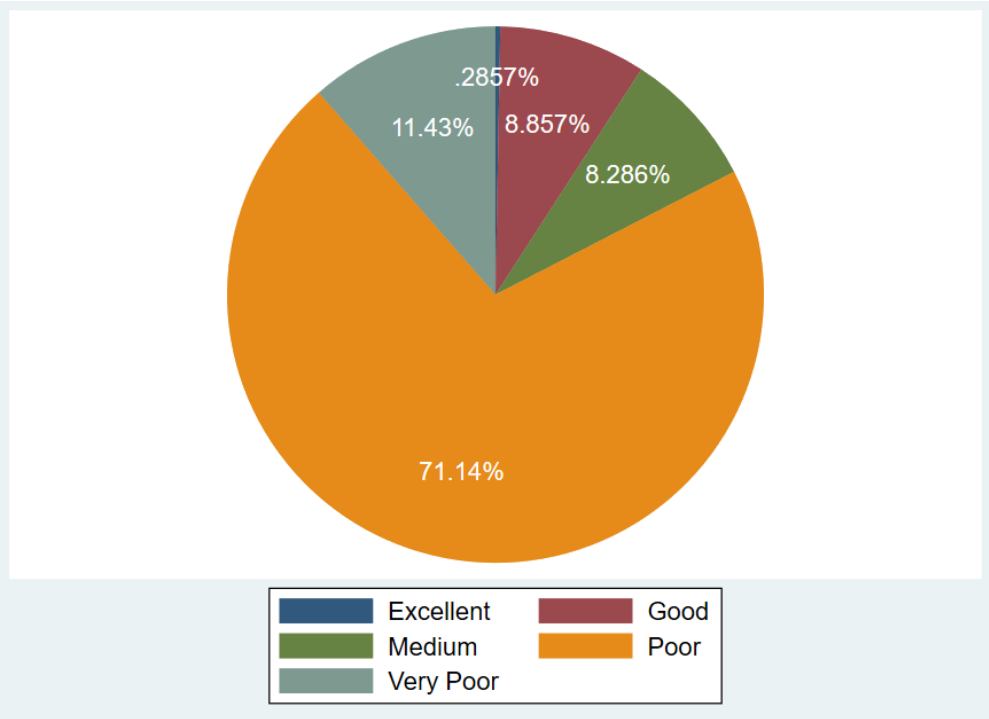


Figure 4-29: Footpath condition survey

Transit Facilities:

In terms of transit facilities 50.86% people think that the facilities are poor condition and 35.14% respondent mark the facility as very poor. The scenario indicates the poor transit facilities in Teknaf only a bus stand is the way to reach this place which is not well organized. For future development, the transit facility should develop in a planned way (Figure 4-30).

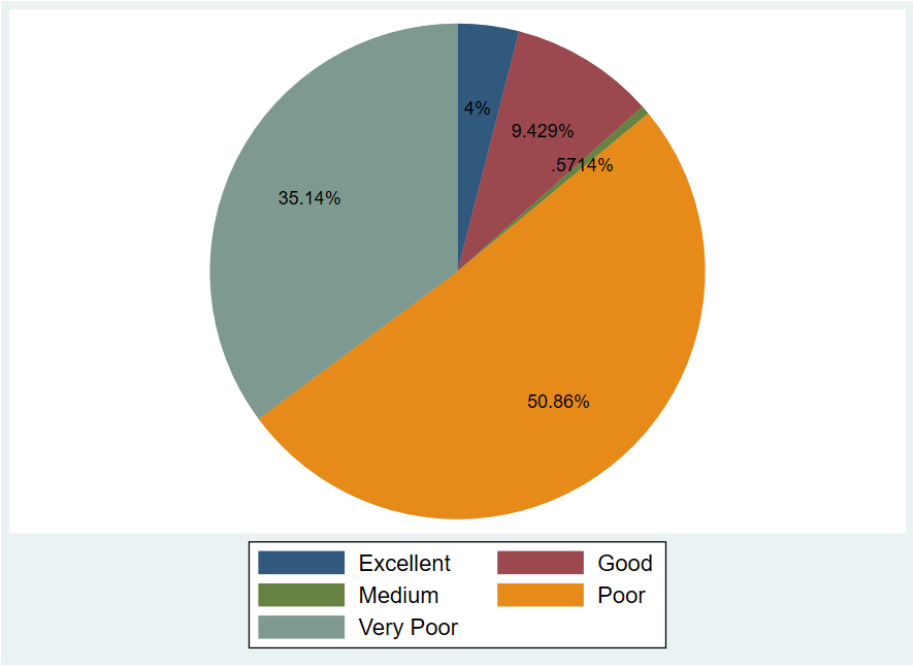


Figure 4-30: Transit facility scenario

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Results

The traffic impact assessment study was conducted to assess the traffic impact after the construction of the cable car project with Naf Tourism Park and Sabrang Tourism in the project location area. Results of vehicle composition shows that most of the vehicles in the traffic flow were motorized vehicles all in three roads of the study area. Among all motorized vehicles three-wheeler (Auto Rickshaw and CNG) contains the maximum proportion and its amount is 55%. Basically, Teknaf is a rural area, and percentage of local people who go outside of Teknaf is less, and they mainly travel within the local area and there is no any public transport except these three-wheelers (Auto Rickshaw and CNG) to travel in the study area, this may be the reason for the high proportion of three-wheelers (Auto Rickshaw and CNG). The analysis shows that all lanes in New Marine Drive road and Old Marine Drive road accomplish the level of service of A category in weekend and weekday peak hour time. The major problem is that we collect data during Covid-19 situations, maybe the reason for less volume of present traffic. The average level of services (LOS) of Teknaf – Cox's Bazar road is in the B category. It means the performance of Teknaf-Cox's Bazar road is lower than the other two roads. The analysis also demonstrates that the average annual daily traffic (AADT) is more in Teknaf-Cox's Bazar road (7819 pcu/day) and less in Old Marine Drive road with the value of 1551 pcu/day. Teknaf-Cox's Bazar road is the main road of travel for all types of vehicles in Teknaf area that's why AADT value of this road so high. Even though an alternative road (Marine Drive road) has been constructed in 2018 from Teknaf to Cox's Bazar, even then traffic volume is high in Teknaf Bus stand road because there's the restriction on movement of several types of public transport. Almost 45% of trips are distributed around Teknaf Bus stand area because this point is the main point of Teknaf Upazila and most people use this point as an origin or destination for their working and non-working trips. Results show that Average free-flow speed and normal flow speed is high in New Marine Drive Road for all types of motorized and non-motorized vehicles because of good conditions of road facilities. The average delay value is high in Teknaf-Cox's Bazar road and its average value is almost 2 hours. This delay occurs due to the worst conditions of existing roadway facilities. Future volume of traffic will increase depends on several factors. When Naf Tourism Park opens for the public then an extra volume of traffic will increase in these areas roads. The analysis shows that volume of future traffic is less than its capacity for the next 20 years in the case of New Marine drive road and Old Marine Drive road. This indicates the future expansion of the existing roadway.

The willingness to pay or feasibility survey reveals that female persons are less than male persons where safety issues should address for this scenario improvement. Young and older person road facilities are not up to mark which need to concern. However, the majority people in this locality want this Naf Tourism Park (93%) and they think it will increase their living standard. Nonetheless, the existing road condition (53.71%) is poor, the footpath (71.14%) is poor condition and transit facilities is very poor (35.14%) and poor (50.86%) condition. However, the existing town has only a bus terminal which is in poor condition. The existing roads have no capacity to meet future traffic demand (2050 traffic volume). It is hard to find parking facilities in the town which is the main challenge for Naf Tourism Park.

Finally, from the analyses it can be concluded that it is not possible to accommodate the proposed change in land use without the implementation of mitigation measures. So it is important to take necessary take some mitigation measures like road conditions, footpath conditions, and transit facilities (parking facilities) development.

5.2 Recommendation

Based on the study findings, the following recommendations can be put forward to improve the present conditions of road facilities, and also to fulfill the future demand:

- There is no bus bay in Teknaf Cox's Bazar road, so bus bay should be constructed to reduce delay time.
- Footpath conditions of the study area are very poor so footpath conditions need to be increased to increase the pedestrian level of services.
- Adequate public transport should be introduced in the study area.
- Different road distresses must be repaired immediately.
- Parking facilities are hard to find which need to improve.
- Carriageway width must be increased.

5.3 Reference

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CHAPTER 6: APPENDIX

6.1 APPENDIX A: Traffic Survey

Traffic Count Survey

Date: __/9/2020 Weather: Sunny/Fair/Cloudy/Rainy To: From:

Traffic Type	**7-8 am**	**8-9 am**	**9-10 am**	**10-11 am**	**11-12 am**	**12-1 pm**
Heavy Truck /container (3-axle)						
Medium Truck (2-axle)						
Light Truck (3 ton or less)						
Large Bus/ Double Decker Bus(40+ seats)						
Medium Bus (16-39 seats)						
Microbus						
Utility/Jeep/Human-Hauler/Laguna/Tempo/Taxi						
Baby Taxi/CNG						
Tempo (Auto Tempo/Auto Rickshaw/Auto-van)						

Motor Bike						
Bicycle						
Rickshaw						
Van						
Animal Cart/Push cart						
Walking						

6.2 APPENDIX B: Speed and Delay Survey

Point: Day: Weekday/Weekend

Vehicle Type	Morning			Evening			Night		
	Free	Normal	Delay	Free	Normal	Delay	Free	Normal	Delay
Heavy Truck /container (3-axle)									
Medium Truck (2-axle)									
Light Truck (3 ton or less)									
Large Bus/ Double Decker Bus(40+ seats)									
Medium Bus (16-39 seats)									
Microbus									
Utility/Jeep/Human-Hauler/Laguna/Tempo/Taxi									
Baby Taxi/CNG									
Tempo (Auto Tempo/Auto Rickshaw/Auto-van)									
Motor Bike									
Bicycle									
Rickshaw									
Van									
Animal Cart/Push cart									

6.3 APPENDIX C: Willing to Pay Survey

Demographic, Origin-Destination, and willing to pay survey

Time: Date: ___/9/2020 To: From:

Demographic, Socioeconomic and Origin-Destination Characteristics

Gender	Male ☐ Fema☐
Age(year)	0-20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ ☐
Education	Primary Education ☐ Secondary Education ☐ Higher Education ☐
Occupation	Student ☐ Service-holder ☐ Businessman ☐ Day laborer ☐ Housewife ☐ Unemployed ☐ Other ☐
Purpose	Home to Work ☐ Home to Other ☐ Work to Other ☐ Work to Home ☐
Monthly Income(BDT)	0 ☐ 1-7999 ☐ 8000-159 ☐ 16000-2 ☐ 9 25000-49999 ☐ 40000 ☐
Frequency of travel (Daily)	1-2 times ☐ 3-4 time ☐ 5+ tim ☐
Origin-Destination	Origin ☐ Destination ☐

Willing to Pay Survey

Are you?	Local ☐ Tourist ☐
Would you prefer to propose a road here to connect with NAF tourism park?	Yes ☐ No ☐

Would you prefer to use this road?	Yes ☐	No ☐			
Which Mode do you like to prepare to use this road?	Bus ☐	Paratransi ☐	Cyc ☐	W ☐	O ☐
Is this road save time and money?	Yes ☐	No ☐			
How much money will save for using this road?(BDT)	10-20 ☐	21-3 ☐	31 ☐	☐	
If no please state the reason. (for no answer)	I do not like tourism ☐	Othe ☐			
Road facilities	Very poor ☐	Poor ☐	Medium ☐	Goo ☐	Exce ☐
Footpath facilities	Very poor ☐	Poor ☐	Medium ☐	Good ☐	Excellent ☐
Transit facilities	Very poor ☐	Poor ☐	Medium ☐	Good ☐	Excellent ☐

6.4 APPENDIX D: Traffic Count Data

New Marine Drive Road (Weekday)

Vehicle Type	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm
Heavy Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium Truck	3	0	2	5	1	4	5	0	3	3	1	3
Light Truck	3	0	6	7	3	10	9	10	9	6	6	3
Large Bus	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bus	2	2	4	4	4	4	3	4	2	4	2	2
Micro bus	18	10	21	14	19	20	28	18	32	22	29	18
Car	10	19	14	18	9	18	18	18	30	15	25	10
CNG	16	24	28	30	38	46	51	46	42	52	35	16
Auto Rickshaw	68	66	118	116	127	138	141	130	119	142	140	68
Motor Bike	13	15	45	39	29	20	24	32	48	88	75	13
Bicycle	1	3	7	4	4	6	3	3	6	12	10	1
Rickshaw	1	0	3	0	2	1	2	0	1	4	1	1
Van	1	0	0	0	0	0	0	0	0	0	0	1
Animal/push	0	0	0	1	0	0	0	0	0	0	0	0

New Marine Drive Road (Weekend)

Vehicle Type	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm
Heavy Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium Truck	8	2	0	0	4	0	0	4	0	4	6	0
Light Truck	4	11	12	4	16	4	8	4	6	12	6	4
Large Bus	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bus	0	0	4	6	4	4	0	3	3	4	5	4
Micro bus	26	8	12	24	40	50	10	14	6	36	28	24
Car	16	8	4	10	6	4	4	9	4	6	8	16
CNG	8	12	22	50	24	42	24	14	34	44	46	18
Auto Rickshaw	24	54	86	84	98	120	28	36	40	128	196	226
Motor Bike	16	24	18	28	24	22	16	4	42	82	250	277
Bicycle	2	0	0	0	0	12	0	4	4	0	4	8
Rickshaw	0	0	4	3	0	0	0	0	0	0	3	2
Van	0	0	0	0	0	0	0	0	0	0	0	0
Animal/push	0	0	0	0	1	0	1	1	0	0	2	1

Teknaf- Cox's Bazar Road (Weekday)

Vehicle Type	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm
Heavy Truck	0	0	1	3	0	1	0	0	2	0	2	1
Medium Truck	12	10	10	0	6	20	13	18	14	11	12	12
Light Truck	15	27	22	24	20	31	21	13	6	7	10	6
Large Bus	0	0	2	0	0	0	0	0	0	0	0	0
Medium Bus	5	11	6	0	5	3	4	4	3	1	1	4
Micro bus	24	75	56	41	45	22	28	23	56	50	34	52
Car	19	37	48	35	40	43	36	64	36	25	24	32
CNG	24	46	67	65	61	67	52	144	105	59	51	100
Auto Rickshaw	260	345	545	550	550	485	450	600	685	460	415	450
Motor Bike	24	91	126	127	125	170	148	196	156	151	133	124
Bicycle	11	12	9	11	10	18	15	20	7	8	6	19
Rickshaw	12	12	17	12	16	16	16	20	5	12	15	8
Van	20	16	30	28	27	26	32	32	13	8	11	13
Animal/push	0	3	0	0	0	0	0	0	0	0	0	0

Teknaf- Cox's Bazar Road (Weekend)

Vehicle Type	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm
Heavy Truck	7	6	1	0	1	0	1	0	0	1	1	3
Medium Truck	5	8	4	7	2	11	3	3	6	9	7	7
Light Truck	8	12	5	8	7	8	6	6	9	10	6	4
Large Bus	10	13	18	8	6	3	0	0	0	3	4	6
Medium Bus	5	11	7	6	5	2	5	4	17	20	19	14
Micro bus	15	23	17	25	18	34	20	31	21	35	17	25
Car	8	5	11	13	8	10	13	14	7	13	23	32
CNG	85	104	137	140	134	131	136	141	172	156	200	226
Auto Rickshaw	137	212	276	230	212	167	139	145	286	290	310	286
Motor Bike	57	53	67	98	72	65	79	86	58	92	111	128
Bicycle	13	13	16	18	12	11	3	3	9	4	9	11
Rickshaw	6	9	10	7	13	4	1	4	7	7	3	8
Van	0	0	5	2	2	6	0	4	3	2	2	2
Animal/push	0	0	0	0	0	0	0	1	0	0	0	1

Old Marine Drive Road (Weekday)

Vehicle Type	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm
Heavy Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium Truck	0	5	0	4	0	0	0	0	0	0	1	0
Light Truck	0	0	1	6	3	2	1	0	4	3	5	0
Large Bus	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bus	0	0	1	0	0	0	0	0	0	0	0	0
Micro bus	0	0	3	4	3	1	1	3	4	2	7	2
Car	0	1	5	1	3	2	0	2	1	1	2	1
CNG	2	6	11	15	15	13	18	9	9	6	13	7
Auto Rickshaw	22	40	71	146	152	180	135	131	175	178	154	134
Motor Bike	12	29	36	61	93	45	34	37	50	42	54	51
Bicycle	2	10	6	7	6	10	2	2	5	2	5	4
Rickshaw	3	0	7	3	0	11	0	2	0	8	2	4
Van	2	4	4	0	2	7	2	2	3	2	4	4

Animal/push	0	1	0	0	0	0	0	0	0	0	0	0

Old Marine Drive Road (Weekend)

Vehicle Type	**7am-8am**	**8am-9am**	**9am-10am**	**10am-11am**	**11am-12pm**	**12pm-1pm**	**1pm-2pm**	**2pm-3pm**	**3pm-4pm**	**4pm-5pm**	**5pm-6pm**	**6pm-7pm**
Heavy Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium Truck	0	0	3	0	1	3	0	0	1	0	0	0
Light Truck	0	4	0	2	3	1	1	0	1	6	0	0
Large Bus	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bus	0	0	0	0	0	0	0	0	0	0	0	0
Micro bus	0	0	1	2	4	3	0	0	1	7	0	1
Car	0	1	2	2	1	1	0	0	1	0	1	0
CNG	4	7	10	14	20	22	6	10	15	20	6	5
Auto Rickshaw	59	82	124	122	157	170	81	116	161	192	135	101
Motor Bike	15	32	32	30	22	48	14	21	23	37	39	21
Bicycle	0	2	8	3	5	9	0	0	5	8	2	0
Rickshaw	0	0	4	4	1	3	1	0	0	5	3	0

Van	0	0	4	0	0	0	0	0	0	1	1	0
Animal/push	0	0	0	0	0	0	0	0	0	0	0	0

6.5 APPENDIX E: Category wise AADT

Category wise Average Annual Daily Traffic (AADT) of New Marine Drive Road

Point Name	Motorized Vehicle										Non-Motorized Vehicle			
Teknaf Beach	Heavy Truck	Medium Truck	Light Truck	Large Bus	Medium Bus	Micro bus	Car	CNG	Auto Rickshaw	Motor Bike	Bicycle	Rickshaw	Van	Animal/ push
Total 24 hour volume (veh/day)	0	43	112	0	55	378	328	666	2092	708	96	22	2	2
DEF	6.530													
Total 7-day volume (veh/week)	0	281	731	0	359	2468	2142	4349	13661	4623	627	144	13	13
ADT (veh/day)	0	40	104	0	51	353	306	621	1952	660	90	21	2	2
MEF	0.884													
AADT (veh/day)	0	35	92	0	45	312	270	549	1725	583	79	18	2	2
PCU Factor	2.5	2.5	1.25	2.5	2.5	1.25	1	1	0.5	0.3	0.3	1	0.5	0.5
Total Category wise PCU	0	87.5	115	0	112.5	390	270	549	862.5	175	24	18	1	1

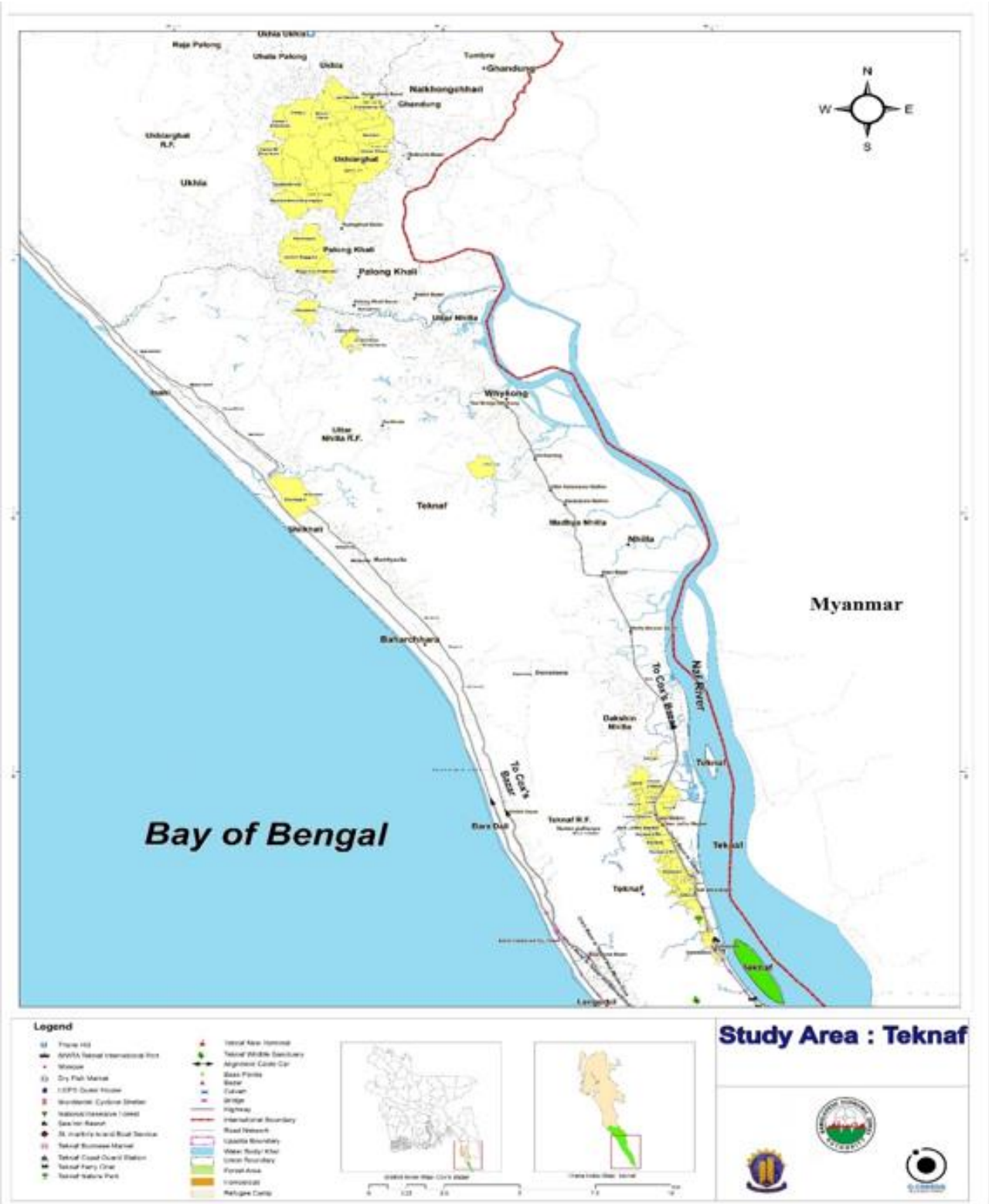
Category wise Average Annual Daily Traffic (AADT) of Old Marine Drive Road

Point Name	Motorized Vehicle										Non-Motorized Vehicle			
Parjatan Bazar	Heavy Truck	Medium Truck	Light Truck	Large Bus	Medium Bus	Microbus	Car	CNG	Auto Rickshaw	Motor Bike	Bicycle	Rickshaw	Van	Animal /push
Total 24 hour volume (veh/day)	0	15	38	0	2	45	24	186	2452	864	93	30	21	3
DEF	6.530													
Total 7-day volume (veh/week)	0	98	248	0	13	294	157	1215	16012	5642	607	196	137	20
ADT (veh/day)	0	14	35	0	2	42	22	174	2287	806	87	28	20	3
MEF	0.884													
AADT (veh/day)	0	12	31	0	2	37	19	154	2022	712	77	25	18	3
PCU Factor	2.5	2.5	1.25	2.5	2.5	1.25	1	1	0.5	0.3	0.3	1	0.5	0.5
Total Category wise PCU	0	30	39	0	5	46	19	154	1011	214	23	25	9	1.5

Category wise Average Annual Daily Traffic (AADT) of Teknaf- Cox's Bazar Road

Point Name	Motorized Vehicle										Non-Motorized Vehicle			
Teknaf Bus Stand	Heavy Truck	Medium Truck	Light Truck	Large Bus	Medium Bus	Micro bus	Car	CNG	Auto Rickshaw	Motor Bike	Bicycle	Rickshaw	Van	Animal/ push
Total 24 hour volume (veh/day)	14	207	270	87	70	742	641	1233	8447	2306	209	237	360	4
DEF	6.530													
Total 7-day volume (veh/week)	91	1353	1764	567	457	4845	4186	8051	55159	15058	1365	1547	2351	26
ADT (veh/day)	13	193	252	81	65	692	598	1150	7880	2151	195	221	336	4
MEF	0.884													
AADT (veh/day)	11	171	223	72	57	612	529	1017	6966	1901	172	195	297	4
PCU Factor	2.5	2.5	1.25	2.5	2.5	1.25	1	1	0.5	0.3	0.3	1	0.5	0.5
Total Category wise PCU	27	427	279	180	142	765	529	1017	3483	570	52	195	148	2

6.6 APPENDIX F: Project Location Map



6.7 APPENDIX G: Photographs of Survey


SSC BATCH 2010