Research Paper

# Characterization based on-street parking management in shopping area of a developing country: A study of Dhaka New Market, Bangladesh

F. Reza [1], A. N. Kakon [2] and K. A. Asad [3]

**A R T I C L E   I N F O R M A T I O N**

**A B S T R A C T**

This study identifies the on-street parking characteristics of Dhaka New Market, a shopping area of Bangladesh. Parking usage survey by patrol was conducted both on weekday and weekend to find out the parking characteristics. The analysis of parking patrol survey data demonstrates that parking accumulation, volume, load and index are much higher at the weekend which indicates raised parking demand than that of weekday. As existing parking supply fail to accommodate higher parking demand spill-over parking is being encouraged and consequently traffic congestion, obstruction to pedestrian movement and bus stop zone have been created. Parking space inventory survey and user opinion survey were also conducted to recognize on-street parking induced problems and to adopt some policy measures in these regards.

## 1.    Introduction

The role of parking spaces in the transportation system is critical (Spiliopoulou and Antoniou, 2012). In many developing cities, high growth of the vehicle fleet has taken place in recent years. The shift towards motorized private road transport reduced the share of other modes. The growth of road traffic overwhelmed the development of the city structures and the supply of sufficient infrastructure. Therefore, in developing cities more than in developed countries the transport system is inefficient, unsafe, causes environmental problems, and disadvantages healthy city development (Breithaupt, et al., 2010). Income and car ownership are major factors that directly affect the demand for parking (Spiliopoulou and Antoniou, 2012). Dhaka, the capital of Bangladesh,

has more than 14 million people, and it has the highest level of car ownership in the country (Kamruzzaman, Haque and Washington, 2014). Vehicle ownership has increased steadily, and at present, the ownership rate is about 2 to 10 vehicles per 1,000 persons (Ahsan, 2012). According to Bangladesh Road Transport Authority (BRTA), every year around 37,000 cars are added to Dhaka's roads, of which 80% are private cars (Ahmed and Rahman, 2008). With the phenomenal increase in personalized motor vehicles, one of the major problems confronted by the motorists is the acute shortage of parking space (Kolhar, 2012).

The commercial land use has a high vehicular and pedestrian traffic generating capacity. Demand for parking spaces and other facilities are high (Osoba, 2012). In Dhaka city, particularly large shopping centers

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[1] Corresponding author, Assistant Professor, Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342, BANGLADESH, farhadrezaurp@juniv.edu
[2] Associate Professor, Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342, BANGLADESH & IALT member, ILMR, Saga University, Saga 840-8502, JAPAN, kakon_urp@yahoo.com
[3] Graduate Student, Department of Department of Urban and Regional Planning , Jahangirnagar University, Savar, Dhaka-1342,BANGLADESH, anik796@gmail.com

attract large volume of traffic. There are around 3,000 roadside shopping centers in Dhaka, and most of them do not have adequate provisions for parking (Rahman, 2010). Insufficient parking facilities at shopping centers as well as the commercial areas have remarkable impact on traffic flow in adjacent roadways (Mahmud, Hoque and Qazi, 2009). People have to park on the roads, which ultimately narrow down the effective road width of the roads to a great extent. These on-streets parking system cause traffic congestion in that particular road and its impact goes to the surrounding roads and areas (Chowdhury, 2013). Recently a study conducted by 'The Chartered Institute of Logistic and Transport' revealed that the traffic congestion of Dhaka city causes nearly $3 billion losses every year (The Daily Star, 2010).

The challenge of managing parking spaces in the urban areas of a multi-modal transportation system is a critical issue for transportation and urban planners (Habib et al., 2012). A systematic study of the parking characteristics and demand; and regulatory measures that are possible for controlling parking is of great help to a traffic engineer as well as a town planner (Kadiyali, 2006). Unfortunately, there is little research on parking condition of Dhaka city (Zannat et al., 2013). This study concentrates on analyzing the on-street parking characteristics of a shopping centre in Dhaka city. New Market shopping area is selected for this purpose. People of different income groups visit this market everyday as it caters their diverse requirements. This open-air shopping complex attracts a huge amount of traffic, a major portion of which are cars that are parked on-street when the market is open for six days in a week. Moreover, the designated space for on-street parking proved to be inapt as the surrounding road is overburdened with parked cars which create traffic congestion (Zannat et al., 2013). By analyzing the on-street parking characteristics, on-street parking induced problems are also identified. Finally, some guidelines have been provided to minimize the on-street parking induced problems around the study area considering parking characteristics.

## 2. Literature review

The amount of literature on parking study in developing countries is considerably less than that related to developed countries. Most of the literatures deal with parking related problems and policy issues. Very few studies address the issue of on-street parking characteristics; especially in case of developing countries.

Yue and Zhang (2003) in their study addressed the importance of parking control and management for the countries under developed but they will sooner or later face the same problems experienced in the developed world. Osoba (2012) conducted a study on parking problem and traffic management in central business district in Lagos, Nigeria. This research work revealed that delays and traffic congestion are as a result of inadequate parking space, traffic signs or signals, human factor indiscipline act and development of illegal stall at car park. Recommendations on parking management, parking design standard, parking control; traffic management for both vehicular and pedestrian, land-use and land development; enforcement of edict and bye-laws by statutory agencies were made to mitigate parking problems without detailed parking characteristics. Barter (2011) conducted a huge study in parking namely parking policy in Asian cities. In case of Dhaka city, he showed that there is acute on-street parking problem and lack of proper management further deteriorates the scenario. But in this study, parameter based parking characteristics have not been analyzed and issues such as non-motorized, freight vehicle parking, curb-side management and parking information and guidance system have been ignored. Islam (2004) conducted a parking study in Motijheel area, Dhaka and found that on-street parking is a big problem there. Moreover, he concluded that there is lack of space for para-transit which deteriorated the situation. Ahmed and Hoque (2012) in their study attempt to focus on the problems associated with uncontrolled and unregulated parking and also to find shortcomings of the different policies being practiced by the regulators i.e. Capital Development Authority (RAJUK) and Dhaka City Corporation (DCC). Zannat et al. (2013) analyzed existing parking demand and supply of New Market. This study conducted parking patrol survey only on working day and had not determined parking index. Tamima (2007) mentioned in her research paper that the demand for parking is directly correlated to growth or decline in the availability of business, employment, shopping and dining opportunities. In her study, it was found that parking at the intersection point, lack of distinctive directional signs, lack of curb and lack of vigorous enforcement by the traffic police were the main problems of the existing parking situation. Parking parameters such as parking accumulation, parking volume, parking duration, parking turnover, spillover parking etc were also discussed. Here, parking characteristics were analyzed on the basis of weekday survey data. Yet, parking characteristics of New Market Area in the weekend showed a different picture; which need to be addressed properly.

This brief review indicates that little has been done in formulating parking policy with considering in-depth parking characteristics of the developing countries. Most

of these studies are merely based on weekday survey data and focus on parking induced problems rather than investigating real characteristics of on-street parking. Therefore, further investigation is warranted by incorporating both weekday and weekend study to formulate effective policy guidelines.

## 3. Data and methods

### 3.1 Data

Data for this study have been collected through different types of surveys. Parking Space Inventory Survey, Parking Usage Survey by Patrol and Parking User Opinion Survey are employed for this study. This study involves different survey methods as well as analytical methods for determining on-street parking characteristics; problems stem from on-street parking and formulating efficient parking management options of Dhaka New Market area. The details of these methods are described in the following section.

### 3.2 Survey methods of determining parking characteristics

#### 3.2.1 Parking space inventory survey

The space inventory survey was conducted at the four locations of New Market Area i.e. front and opposite of Gate no. 1, Gate no. 2 to Gate no. 4, New Market North to Dhaka College and Globe Shopping Center to Nilkhet Intersection (Fig. 1). In these sites data on road width, number of parking lot, types of parking (horizontal, vertical), location of the pedestrian crossings, bus stops and loading-unloading zones, sign, symbol, marking, on-street parking induced problems and surrounding land use pattern of New Market Area were collected.

#### 3.2.2 Parking usage survey by patrol

This survey was conducted to determine the on-street parking characteristics such as parking accumulation, volume, load, parking index and spillover parking. For conducting patrol surveys following steps were carried-out.

##### (a) Mapping street system

Before conducting patrol survey a street map of the study area was prepared showing the locations of the on-street parking space according to space inventory survey. The patrol survey was conducted in these locations. The observations were recorded from both sides of the roads. The street segments, direction of patrol path are shown in **Fig. 1.**

##### (b) Frequency of patrol

A single patrolling for on-street parking was completed by the half an hour time period for each patrol section. This frequency of data recording continued over the study period.

##### (c) Observation method

The patrols were made on foot once every half an hour and information on the registration number and other relevant facts of each vehicle was recorded in a prepared patrol survey form. A team of two observers were set up for each section. For each section, two observers conducted the first patrolling of thirty minutes and then they returned to the terminal point of the segment for completing the second patrol. This process was continued over the study time period for all four segments.

##### (d) Survey timing

The survey was conducted both on weekend (7 March, 2014) and weekday (23 April, 2014) for duration of eight hours from 11:00 am to 7:00 pm. This two survey days were selected randomly by considering weather condition, political situation and availability of surveyor. Lunch break was taken from 2:00 pm to 2:30 pm (30 minutes) during the survey period.

##### (e) Tools and form of recording

Each observer was equipped with a watch, a pencil, prepared patrol survey forms, a board and map of the street.

#### 3.2.3 Parking user opinion survey

A questionnaire survey was conducted among parking user to know about their origin and opinion on parking related issues. Fifty respondents from each patrol segments were randomly selected (total 200) to respond to the questionnaire in these purposes.

### 3.3 Analytical methods of determining parking characteristics

By studying relevant literature, it was found that parking inventories involve various parameters such as parking accumulation, parking volume, parking load, parking index, parking turnover and spill over. However, all these parking parameters are not considered in previous studies on New Market area. Since the parking scenario of the study area is quite intricate, this is more rationale to incorporate all the parameters. These parameters are sequentially described in the following section as mentioned in "Introduction to Transportation Engineering" by Mathew and Rao (2006).

*(a) Parking accumulation*

It is defined as the number of vehicles parked at a given instant of time. Normally this is expressed by accumulation curve. Accumulation curve is the graph obtained by plotting the number of bays occupied with respect to time.

*(b) Parking volume*

Parking volume is the total number of vehicles parked at a given duration of time. This does not account for repetition of vehicles.

*(c) Parking load*

Parking load gives the area under the accumulation curve. The parking load is closely related to the parking accumulation and helps to develop the peak and off-peak parking period of the study area.

$$\text{Parking Load (vehiclehour)} = \frac{\text{sum of accumulation for each time interval x time interval (min.)}}{\text{total survey time (min.)}}$$

[1]

*(d) Parking turnover*

Turnover is the ratio of different number of vehicles parked in a duration to the number of parking bays available. This can be expressed as number of vehicles per bay per time duration.

$$\text{Average Turn - over (vehicle per bay)} = \frac{\text{sum of turn - over}}{\text{total number of bay}}$$

[2]

*(e) Parking index*

Parking index is also called occupancy or efficiency. It is defined as the ratio of number of bays occupied in a time duration to the total space available. It gives an aggregate measure of how effectively the parking space is utilized. Parking index can be found out as follows.

$$\text{Parking index} = \frac{\text{parking load}}{\text{parking capacity}} \times 100$$

[3]

Here, parking capacity indicates total number of bay available for parking.

*(f) Spill over*

Vehicles which are not parked in the designated place are known as spillover (Tamima, 2007).

## 4. Study area

New market is one of the famous and old markets in Dhaka city (Shahjahan, 2009), located at Azimpur, with Mirpur Road on one side and Pilkhana Road on the other (Media Bangladesh, 2012). After its opening in the year 1954 on 35 acres of land, it served the inhabitants of Dhaka city which is now serving people outside of Dhaka as well (Media Bangladesh, 2012). There are 468 shops, occupying a total floor area of 560,683 square feet. The central triangular market area and the eastern and western edges are one storied, while the northern edge is extended up to three storeys (Zannat et al., 2013). One of the distinctive features of Dhaka New Market is shopping in open air and in a spacious atmosphere. The three high arched gates lead to organized rows of shops for books and stationery, watches, clocks and spectacles, leather goods and travel kits, grocery items, clothes, jewelry, electrical equipment etc and a few service shops of tailoring, fast food, photography etc (Dhaka New Market, 2016) **(Fig. 1).**
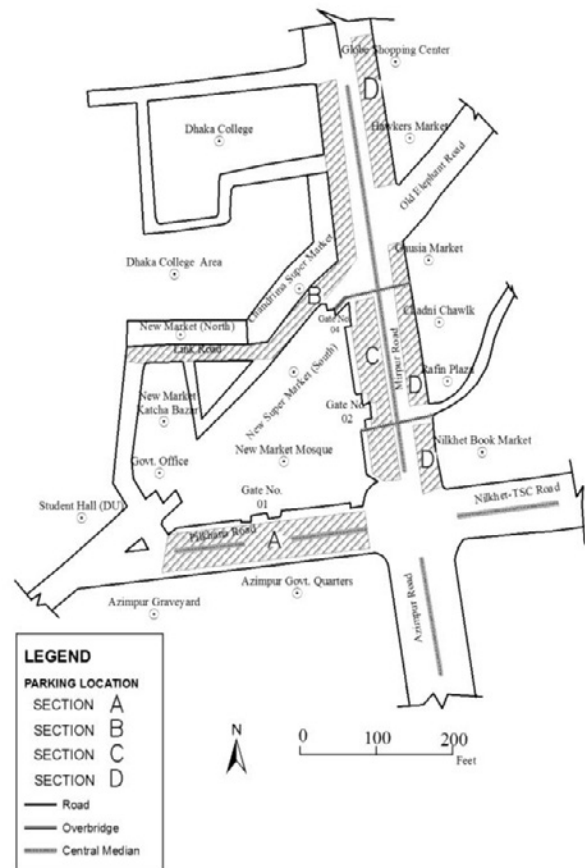


**Fig. 1.** Layout of Dhaka New Market.

Parking Space Inventory Survey reveals that, land use pattern of the New Market area mainly built up with commercial activities. In this area establishments are mainly developed along the Mirpur road. Along this road some other commercial centers i.e. Balaka Cinema Hall and Nilkhet Book Market and two educational institutions i.e. Dhaka College and Teachers Training College are also found. At the Pilkhana Road section, Government

staff quarters are established. Home Economics College and Eden Women College is placed at the Azimpur road. At the Link road section a Dhaka University Students' Hall and some commercial buildings are established.

*Existing parking facilities*

The area has both designated and undesignated on-street parking lots around (Tamima, 2007). At the four locations of New Market Area, designated on-street parking facilities are available **(Table 1, Fig. 1).**

**Table 1.** Parking facilities of the New Market Area.

| Location | Parking Type | No. of Bays |
|---|---|---|
| Sec. A (Gate No 1) | On-street Vertical | 110 |
| Sec. B (New Market North to Dhaka College) | On-street Vertical | 28 |
| Sec. C (Gate No 2 to Gate No 4) | On-street Vertical and Horizontal | 55 |
| Sec. D (Globe Shopping Centre to Nilkhet Intersection) | On-street horizontal | 46 |
| Total no. of Parking Bays | | 239 |

There is provision of parking charge collection from all these sections except Section D. Parkers can park their vehicles by taking a ticket from the authorized person in rest of three places. Dhaka South City Corporation (DSCC) leases these three places to a private enterprise named "Rimon Enterprise" which is responsible for collecting parking charge and maintaining the parking place. The authority has fixed BDT 20 as parking charge per vehicle for the entire business hour.

## 5.    Results and discussions

### 5.1  On street parking characteristics

The patrol survey was conducted on parked vehicles within eight hours time period both in weekday and weekend. The findings of the survey data of weekday and weekend regarding six parking parameters i.e. parking accumulation, parking volume, average parking turnover, parking load, parking index and spillover parking are presented in the following sections.

### 5.1.1    Parking accumulation

The Parking Accumulation Curve **(Fig. 2)** indicates that on the weekday peak period lies between 6:30 pm to 7:00 pm when maximum number of vehicle accumulated. On the other hand, from 11:00 am to 11:30 am the number of accumulated vehicle is minimum than other time period. The curve tends to rise after 12:00 pm and

continues up to 1:00 pm because more people come to the market with their vehicles. The curve then starts to slope down till 3:30 pm because buyers leave the market for lunch. After 3:30 pm the curve starts to rise till 7:00 pm. From 4:30 pm to 7:00 pm the accumulation is raising at higher rate because maximum buyers enters this market area at the afternoon session.
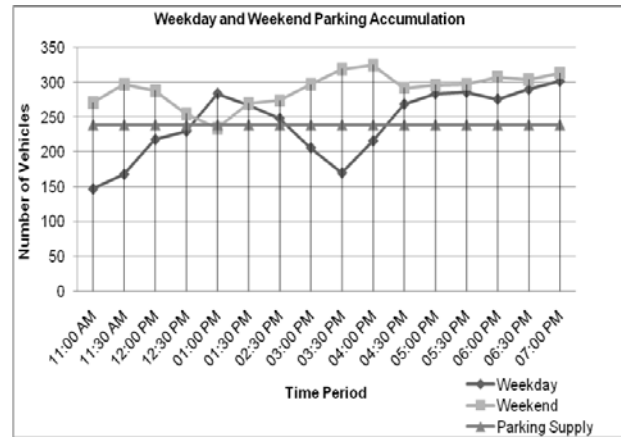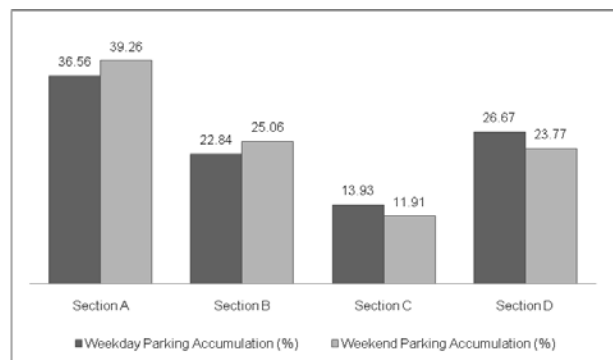


**Fig. 2.** Parking accumulation of Dhaka New Market.

At weekend **(Fig. 2),** the scenario is far different. Except the lunch period (12:30 pm-1:00 pm), parking accumulation is higher throughout the day as more buyers enter to the market area to buy their necessary products. Usually maximum buyers come to the market after lunch and prayer; hence the accumulation reaches to the highest peak in the afternoon from 3:30 pm to 4:30 pm.

*Section wise parking accumulation*

At weekday, Section A of the New Market area shares higher portion of the total accumulation and Section C shares lower portion of the total accumulation **(Fig. 3).** In fact, New Market Shopping Complex (New Market North, New Market South, Bonolota Food Market) accumulates 73.33% of the total traffic to this area.



**Fig. 3.** Section wise parking accumulation.

At weekend, Section A shares higher portion of the total accumulation **(Fig. 3).** As usual New Market

Shopping Complex (New Market North, New Market South, Bonolota Food Market) accumulates 75.33% of the total traffic to this area.

### 5.1.2 Parking volume

From weekday survey, it is found that 2051 vehicles were surveyed in eight hours survey period. This means 2051 different vehicles were parked at the survey period. If the calculation is made for 15 hours time period the average number of vehicle turns out to 3846. On the other hand, the expected number of vehicles in accordance with 239 parking capacity during 15 hours time span will be 3585 **(Fig. 4)**.
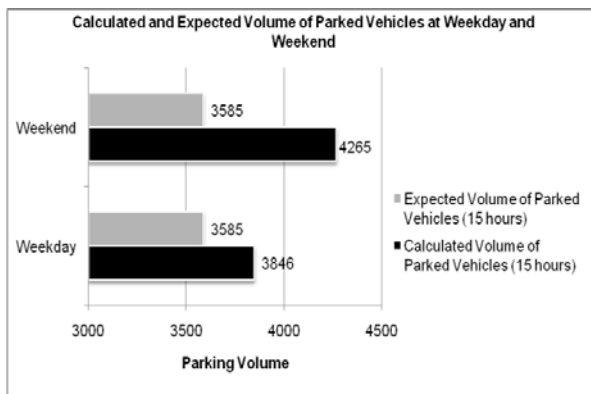


**Fig. 4.** Parking volume of Dhaka New Market.

At weekend, it is found that 2275 vehicles were surveyed from eight hours survey period. If the calculation is made for 15 hours time period the average number of vehicle turns out to the 4265. On the contrary, the expected number of vehicles in accordance with 239 parking capacity during 15 hours time span will be 3585. This data indicates higher parking demand in New Market area and at weekend this demand raise significantly.

### 5.1.3 Parking load

Parking load has been calculated using Eq. [1] before lunch and after lunch period as mentioned in **Table 2** to address the parking pressure period. Here, lunch period ranges from 1:30 pm to 2:30 pm.

**Table 2.** Parking load before and after lunch period.

| Time Period | Parking Load in Weekday | Parking Load in Weekend |
|---|---|---|
| 11:00 am to 1:30 pm | 1448 | 1741 |
| 2:30 pm to 7:00 pm | 2413 | 2901 |

The table reveals that on weekday as well as weekend the parking load is maximum after lunch period as buyers have tendency to come to the shopping center in the afternoon after having their lunch rather than earlier period of the day. The total parking load is comparatively higher at weekend than that of weekday.

### 5.1.4 Parking turnover

From the weekday survey data it is found that, the rate of usage of available parking bay is 9 vehicles per bay per hour in a period of 8 hours. On the contrary, weekend survey indicates that, the rate of usage of available parking bay is 10 vehicles per bay per hour in a period of 8 hours. If the expected number of vehicles (1912) for the 8 hours survey period is considered then the expected average turnover will be 8 (Eq. 2). So, it is evident that the parking bay is used more than the expected demand.

### 5.1.5 Parking index

Parking Index at four sections by Eq. [3] is summarized in **Table 3.** At Section C, the parking index is higher (130) than the other three sections in a weekday. On the other hand, at the section A parking index is lower (80). But the average parking index of the study area is 105 **(Table 3)** which indicates the over efficiency of the parking space or the higher demand of parking facility. This means the available parking spaces are over used.

**Table 3.** Section wise parking index of the study area.

| Section | Parking Index | |
|---|---|---|
| | Weekday | Weekend |
| Section A | 80 | 103.6 |
| Section B | 100 | 132.7 |
| Section C | 130 | 139.13 |
| Section D | 110 | 125 |
| Average Parking Index | 105 | 125.11 |

At weekend, for all the four sections the parking index is higher than that of weekday. Parking index is the highest (139.13) at Section C followed by Section B (132.7) among the four sections as these areas possess relatively less number of parking bays.

### 5.1.6 Spill-over parking

Spillover parking is observed both on weekday and weekend **(Table 4).** Lack of designated parking space at the roadside catalyzes spillover parking in the New Market Area. Comparatively at the weekend the parking pressure is higher than weekday so the spillover parking accumulates at higher rate at weekend. Designated space become scarce at the weekend due to the over accumulation of the vehicle at that day.

**Table 4**. Section wise spillover parking.

| Time Period | Section A | | Section B | | Section C | | Section D | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Weekday | Weekend | Weekday | Weekend | Weekday | Weekend | Weekday | Weekend | Weekday | Weekend |
| 11:00 AM | 0 | 0 | 0 | 7 | 0 | 6 | 8 | 23 | 8 | 36 |
| 11:30 AM | 0 | 4 | 0 | 22 | 0 | 7 | 3 | 25 | 3 | 58 |
| 12:00 PM | 0 | 8 | 0 | 17 | 0 | 3 | 18 | 21 | 18 | 49 |
| 12:30 PM | 0 | 0 | 5 | 9 | 6 | 0 | 15 | 25 | 26 | 34 |
| 1:00 PM | 0 | 0 | 10 | 1 | 10 | 0 | 29 | 31 | 49 | 32 |
| 1:30 PM | 0 | 0 | 7 | 19 | 11 | 7 | 18 | 23 | 36 | 49 |
| 2:30 PM | 0 | 18 | 9 | 15 | 5 | 0 | 16 | 9 | 30 | 42 |
| 3:00 PM | 0 | 13 | 0 | 20 | 0 | 0 | 10 | 25 | 10 | 58 |
| 3:30 PM | 0 | 26 | 0 | 23 | 0 | 12 | 3 | 19 | 3 | 80 |
| 4:00 PM | 0 | 16 | 0 | 24 | 10 | 14 | 18 | 32 | 28 | 86 |
| 4:30 PM | 0 | 9 | 13 | 21 | 11 | 10 | 19 | 13 | 43 | 53 |
| 5:00 PM | 0 | 5 | 13 | 18 | 15 | 8 | 19 | 26 | 47 | 57 |
| 5:30 PM | 0 | 7 | 2 | 14 | 13 | 17 | 33 | 20 | 48 | 58 |
| 6:00 PM | 0 | 10 | 12 | 22 | 16 | 10 | 24 | 27 | 52 | 69 |
| 6:30 PM | 0 | 9 | 8 | 28 | 14 | 11 | 32 | 17 | 54 | 65 |
| 7:00 PM | 8 | 7 | 15 | 23 | 11 | 14 | 29 | 31 | 63 | 75 |
| **Total** | 8 | 132 | 94 | 283 | 122 | 119 | 294 | 367 | 518 | 901 |

**Table 4** states that, the spillover parking is less (8) at the Section A than the other three sections. Lack of traffic management and enforcement creates spillover parking on the other three sections.

At Section D spillover parking is higher (367) than the other three sections at weekend; as at this intersection is not designated properly for on-street parking space. Actually, two wheelers vehicle (bicycle, motor bike) creates this spillover at that point.

Results of parking parametric characteristics and user opinion survey can be summarized as:

- At weekday, parking accumulation raises between 4:30 pm to 7:00 pm; whereas except lunch period (12:30-1:30 pm) parking accumulation is higher throughout the day at weekend.
- Section A shares the highest proportion of parking accumulation both at weekday and weekend. Section C, in reverse, holds the lowest portion of the accumulation in both days.
- Higher parking volume is observed during weekend than that of weekday in all sections.
- On weekday as well as weekend the parking load is maximum during 2:30 pm-7:00 pm as buyers have tendency to come in the shopping center in the afternoon after lunch period.
- Parking turnover results indicates that, parking bays are used more than the expected demand.
- The average parking index of the study area is much higher at the weekend than that of weekday. At weekend parking index is the highest (139.13) at Section C followed by Section B (132.7) and D (125). These areas

possess relatively few number of parking bays, spill over parking and violation of traffic rules.

- Limited number of designated parking bays along with violation of parking regulation catalyzes spill over parking at Section B and D. Consequently, road encroachment, creation of conflict points, obstruction to pedestrian movement and bus stop zone take places in these sections.
- Overall parking demand is much higher at weekend which warrants special management considerations.
- Maximum numbers of the shoppers come from the Mirpur (36%), Mohammadpur (31%), Shyamoli (22%) and Uttara (8%) for shopping purposes.
- The parking user survey (2014) reveals that, a significant portion of the users (35%) wants better public transport facility and they are eager to shift their modal choice from private transport to public transport.
- Most of the respondents (72%) argue for multistoried parking space to reduce the existing parking problems.

*5.2 On-street parking induced problems*

Analysis of on-street parking characteristics in terms of parking accumulation, volume, average turnover, load, index and spillover parking reveals high parking demand in New Market Area. Inefficient parking management further deteriorates the condition. Major parking induced problems are described in the following section.
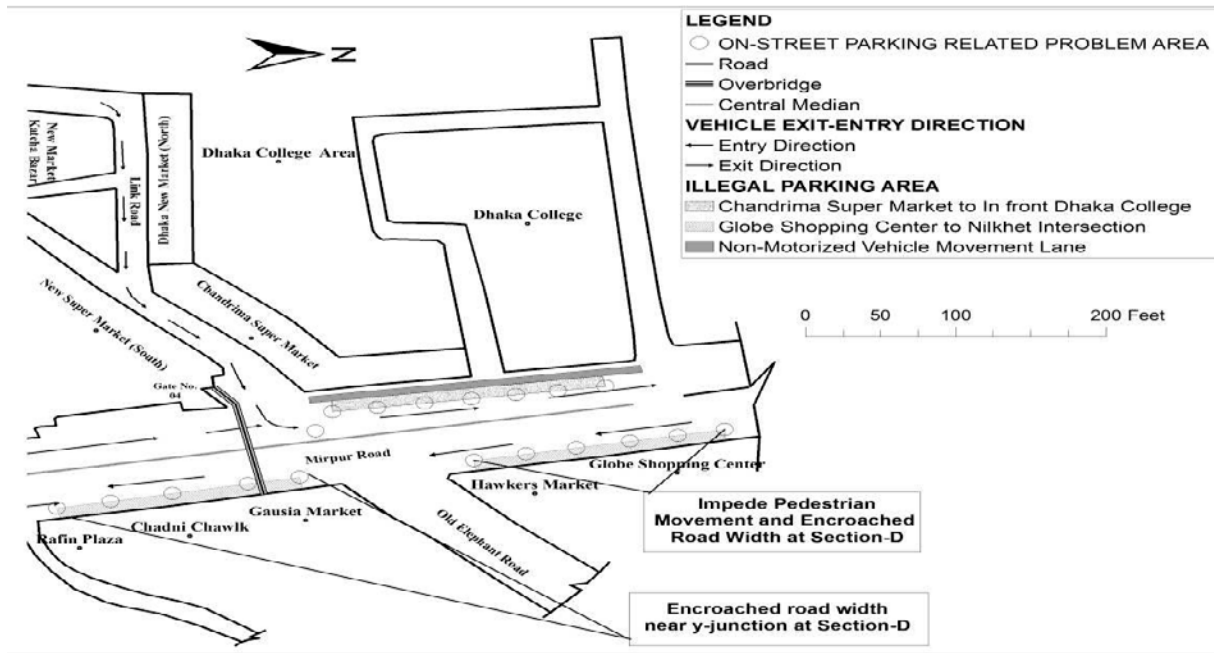
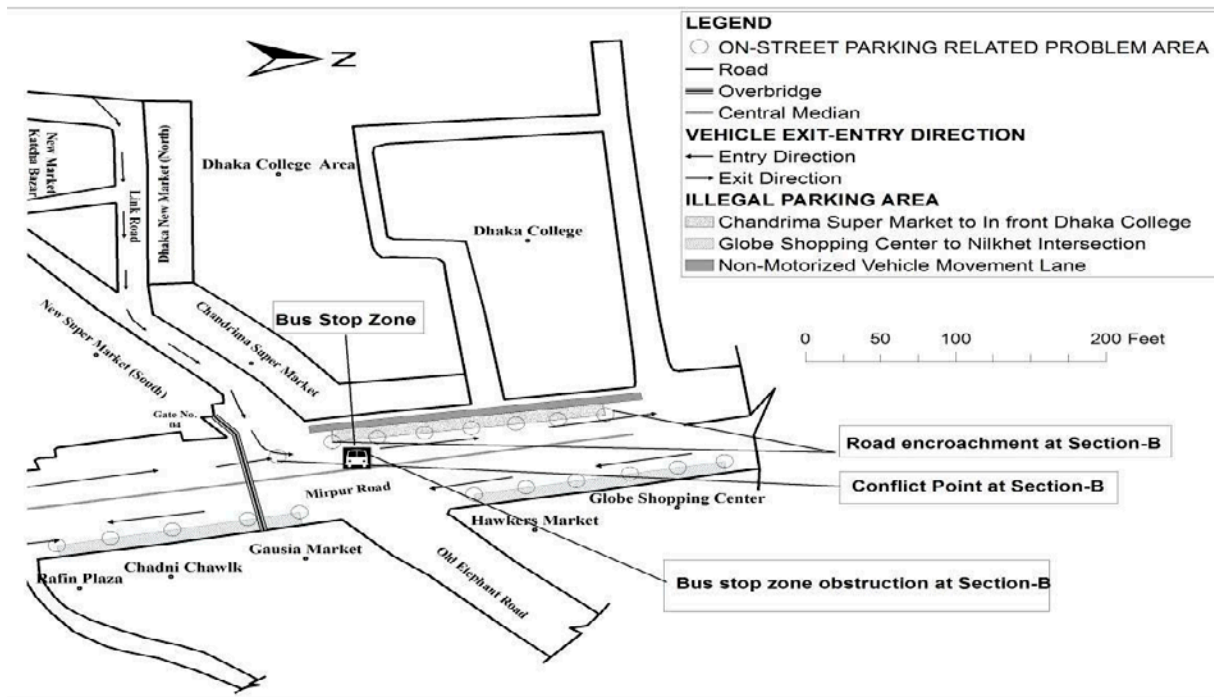**Fig. 5.** On-street parking induced problems at Section D.



**Fig. 6.** On-street parking induced problems at Section B.

*5.2.1    Encroachment of road width*

Undesignated on-street parking encroaches the effective road width and thereby hampers normal traffic flow. In the study two parking places are found i.e. Section B and D; which are not designated for on-street parking facilities. But due to inadequate supply of off-street parking facilities these places along the Mirpur Road are used as on-street parking place. **Table 5** states

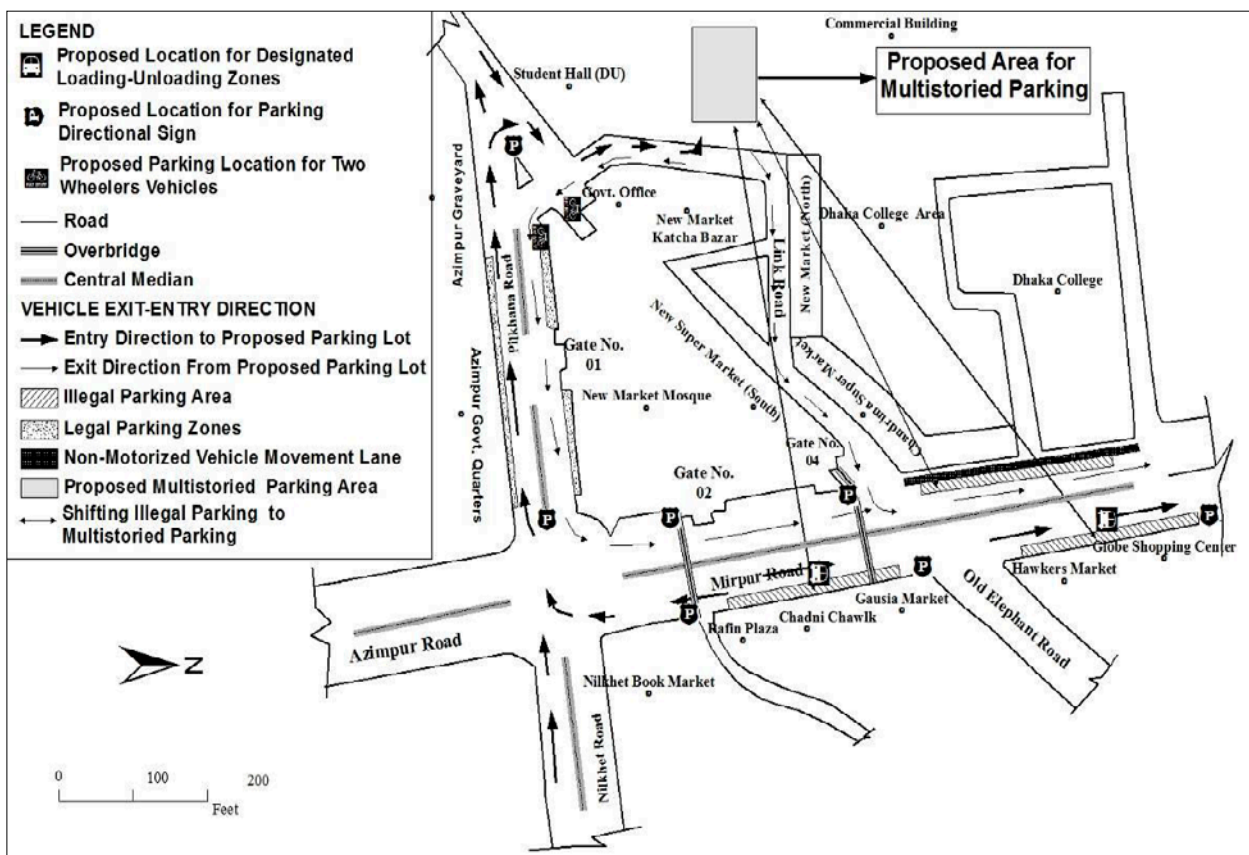the encroachment of road width due to undesignated on-street parking.

**Table 5.** Road encroachment

| Name of Road Section | Road Width (in feet) | Encroachment (in feet) |
|---|---|---|
| Section B | 45 (per lane) | 7 |
| Section D | 45 (per lane) | 5 |

**Table 6.** Parking management option matrix.

| Problems | Designated Design Implementation | Adopting Proper Sign, Marking | Designated Loading-unloading Hours | Efficient Use of Designated Parking Space | Penalty for Illegal Parking | Up gradation of Parking Pricing Mechanism | Improvement of Public Transport System | Provision of Two Wheeler Parking Space | Multi-storied Parking Facility |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Management Options** | | | |
| Road encroachment | √ | √ | √ | √ | √ | √ | √ | | √ |
| Creation of conflict point | √ | √ | | √ | √ | | √ | | √ |
| Impede pedestrian movement | √ | √ | √ | √ | √ | | √ | √ | √ |
| Obstruction to bus stop zone | √ | √ | √ | √ | √ | √ | √ | | √ |



**Fig. 7.** On-street parking management options.

At Section B, cars are parked parallel along the road divider. On an average, 15 vehicles are found parked here at different time intervals. It has been observed that 7 feet of this lane is encroached by the parked vehicles and thereby reduced the effective road width **(Figs. 5 and 6).**

### 5.2.2    Creating conflict points
At Section B there is a lane for non motorized vehicle; separated by a divider along Mirpur road which connects New Market to the Dhanmondi Residential Area. Due to illegal on-street parking as well as opposite flow of non motorized vehicle a conflict point has been created at Section B **(Fig. 6).**

### 5.2.3    Impede pedestrian movement
Pedestrian    movement    is    impeded    by    the undesignated on-street parking at the Mirpur road. Haphazard distribution of the parked vehicles at the

**Table 7**. On-street parking management.

| Management Option | Implementation Strategy | Reasons |
|---|---|---|
| Implementation of Designated Design | ▪ Parallel and vertical parking designated for each section should be maintained.<br>▪ New Market Authority and Dhaka South City Corporation should follow the designated design strictly and monitor regularly. | ▪ At Section B parallel parking accommodates 16 vehicles; whereas, 28 vehicles can be accommodated within the same space if vertical parking can be implemented. |
| Adopting Proper Sign, Symbol and Marking | ▪ Sign, symbol and marking should be placed at designated spaces of Section A and Section C (Fig. 7).<br>▪ These must be clearly visible for all upcoming parkers so that they can park their vehicles at the right area. | ▪ Lack of proper signs, symbols and marking make it difficult for a newcomer to understand which place is designated for parking. |
| Designated Loading-unloading Hours | ▪ Delivery vans should be allowed only at off peak period of the day in two different slots at 6:00 am - 8:00 am and 9:00 pm - 10:00 pm to conduct their activities. | ▪ At present there is no designated loading-unloading zone in New Market area. |
| Efficient Use of Designated Parking Space | ▪ The market authority should shift waste disposal container to the other suitable place.<br>▪ Spaces should be provided for the hawkers inside the market area as more vehicles can be accommodated. | ▪ A waste disposal container occupies a portion of legal parking space at Section A,.<br>▪ Designated parking space is occupied by the street hawkers at Section B. |
| Penalty for Illegal Parking | ▪ The traffic Police of Dhaka Metropolitan Police (DMP) will impose the penalty according to their law.<br>▪ Appointed personnel by the leaseholder of the parking space will help police to identify the illegal parking. | ▪ Penalty should be imposed on the parkers who parked the vehicle at the undesignated space. This approach will help to reduce the illegal parking tendency. |
| Up gradation of Parking Pricing Mechanism | ▪ Parking charge should be fixed on hour basis such as BDT 30 for the 1st hour and BDT 20 for next each hour.<br>▪ On-street parking charge should be higher than off-street parking charge. | ▪ The present parking charge is BDT 20 per vehicle for all day long. So, parkers have a tendency to park their vehicles for the whole day by paying marginal charge. |
| Improvement of Public Transport System | ▪ Bus routes of Mirpur, Mohammadpur, Shyamoli and Uttara should be developed and maintained properly. | ▪ Maximum numbers of shoppers come from these areas to New Market.<br>▪ A significant portion of the users wants better public transport facility to shift their modal choice. |
| Provision of Two Wheeler Parking Space | ▪ Parking space for two wheeler vehicles (Bicycle & Motor Bike) can be accommodated at Section A (Fig. 7).<br>▪ This space should be designed with adequate sign, marking and facilities for the upcoming two wheeler vehicles. | ▪ Separate parking space for the two wheelers will encourage many buyers to alter their travel mode from private car to two wheeler vehicles especially who comes to the market area individually. |
| Multi-storied Parking Facility | ▪ There is a space of 7600 sq. ft at the western side of the Bonolata Kitchen Market (Fig. 7). This place is well connected with Section B and D of New Market area. A multi-storied parking facility can be constructed at this place. | ▪ On-street parking at Section B and D can be shifted to the proposed multi-storied parking site, which will conserve the effective road width.<br>▪ More vehicles parked in other sections can also be accommodated here. |

Globe Shopping Center and Chadni Chawlk Shopping Complex preclude smooth pedestrian movement **(Fig. 5).**

*5.2.4    Obstruction to bus stop zone*

Haphazardly parked vehicles impede not only pedestrian movement but also obstruct bus stop zone at Section B **(Fig. 6).** For the parked vehicles, bus cannot stop at its designated stoppage which hampers the natural flow of the running vehicles.

*5.3   Management options*

Higher parking demand along with inefficient parking management of New Market result in road encroachment,

creation of conflict points, impede pedestrian movement and obstruct bus stop zone. A parking management option matrix has been developed to mitigate these problems **(Table 6)** considering the parking characteristics (especially at weekend); parking induced problems and parkers' perspective. This matrix illustrates problem wise parking management option(s). **Table 7** states management options, implementation strategies and reasons behind adopting these options. Management options such as proposed parking location for two-wheeler vehicle, parking directional signs, proposed multi-storied parking space are presented in **Fig. 7**. These strategies should be adopted and

implemented firmly to enhance the parking facilities of Dhaka New Market area.

## 6. Conclusions

Parametric analysis on on-street parking characteristics of Dhaka New Market area reveals that existing parking facilities cannot accommodate the parking demand particularly during the peak period of the day (after 2:30 pm). Calculated parking turnover and index results indicate that the existing designated parking spaces are over-used; in other words, there is shortage of parking space. This situation turns more acute at the weekend. Scarcity of parking supply, mismanagement and inefficient use of existing parking space, reluctance on enforcement of traffic rules encourage spill-over parking which encroach effective road width and consequently traffic congestion, obstruction to pedestrian movement and bus stop zone have been created. Clearly, much can be done to improve the parking facility in the shopping area like Dhaka New Market. Some policy based management options and implementation strategies have been suggested here to attenuate on-street parking induced problems. Proper implementation, enforcement and regular monitoring are critical in this regard. Characterization based on-street parking study have significance to urban policy makers so that a precise scenario on the nature and depth of parking induced problems can be recognized and apposite measures can be adopted considering local realities.

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