

# **Travel Demand Management (TDM) Measure as a Solution of Traffic Problems of Dhaka City**

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## **Introduction**

Dhaka is the capital and the largest city of Bangladesh. Dhaka has the distinct primacy in the national and regional urban hierarchy. Administrative functions and all other functions are over concentrated in this capital city. City population is increasing along with these functions. But the city is unable to serve its existing dwellers, then how it will be able to serve the newcomers. In a report of National Institute of Population Research and Training (NIPORT) it was estimated that, about 130 million people are living in this city which is increasing day by day. Population density is about 27,700 per square km. According to BRTA everyday more than a hundred vehicles are being added to the total. With the respect of vehicles both private and public, the road network and other facilities are not increasing. All these are affecting the transportation system of the city.

The transport sector in Dhaka is composed of many different modes of travel - both motorized and non-motorized, which use the same road space, resulting in a high level of operational disorder. Dhaka is one of the most unplanned cities of its size as well as without a well organized transportation system. The worsening traffic conditions are causing traffic congestion resulting in increasing delays. The intolerable traffic congestion of Dhaka city has become an everyday certainty and a nightmare for the city dwellers. Traffic congestion is increasing day by day and causing more environmental pollution and making the travel time high. Moreover, the buses are losing their reliability and trip attraction capability. The commuters are becoming less motivated to use public transportation especially bus service. All these are affecting the city economy. It has been identified that due to the traffic congestion the total economic loss of Dhaka is about US\$ 27.5 million per year (Ahsan, 2003). In past days, a lot of initiatives were taken by the government of Bangladesh. But none of them brought any significant change in the prevailing problems. The reason could be all these plans and policies were related to the supply side of the transportation ignoring demand side.

Traffic problems in Dhaka city are increasing as a consequence of both higher mobility and increasing car ownership of people. On the other hand the supply of transport infrastructure and facilities remains practically unchanged due to the high cost of land acquisition and construction of new roads. But the main reason could be the unavailability of lands to construct new service facilities. However, it is well known from basic transport economics that a higher level of supply will result to an increase of demand and finally the transport system will reach a new equilibrium point at a higher level. But for Dhaka city the demand for new service and facilities are increasing day by day but the supply of transport infrastructure are not increasing. To meet the exploding demand transport experts had come with a new concept of Transport Demand Management (TDM).

Transportation Demand Management (also known as mobility management) is often defined as a set of strategies used to encourage a balanced use of transportation resources. In many instances, this approach is applied to areas where automobile use is the dominant mode of transportation contributing to congestion on the roadway network. Every City's General Plan

clearly states a reduction of automobile use as a primarily goal, which will help to achieve the sustainable transportation system for the city as well as for the country.

TDM measures aim at managing transport demand during specific time period. The idea in any case is that TDM measures discourage people from excessive and irrational use of private cars, they cause mode shift to environmentally friendly modes and thus they result in better traffic and environmental conditions. In this respect many research efforts have been undertaken recently in several urban areas from different countries around the world to study the impacts and the effectiveness of such measures (Papaioannou and Georgiou, 2000). Application of TDM strategies is a proven way to help achieving this citywide goal.

This paper aims to explore the existing transportation problems in Dhaka city after reviewing secondary materials and from personal observations. Using secondary literature this paper tries to familiarize with TDM and its effective strategies implemented various countries to solve their transportation problems. A number of success stories has been plotted here to understand the applicability of TDM to solve transportation problems. Finally this paper tries to, find out the scope of TDM strategies to solve existing transportation problems and how TDM could be an effective tool to ensure better transportation system for Dhaka city.

### **Data Sources and Methodology**

This research is based on secondary sources of data and information, and personal observations. In the analysis, both published and unpublished materials were considered, including books, journals, reports etc. These materials helped to develop the concept as well as to understand the extent of the prevailing problems.

### **Travel Demand Management (TDM): Concepts and Strategies**

#### *Clarifying the Concepts*

The terms Travel Demand Management (TDM) and Transportation Systems Management (TSM) are often employed loosely. In a nutshell, they can be defined in many ways, but the important thing is these two terms are different in application. Regional Transportation Plan of California, 2008 defines these terms as follows:

#### ***Transportation Systems Management***

Supply-side approaches to cost-effectively increase system performance: short of costly capacity additions.

#### ***Transportation Demand Management***

Demand-side approaches to cost-effectively increase system performance: short of travel prohibitions.

These close related issues could be distinguished easily with the help of some examples. Some examples of Transportation System Management and Transportation Demand Management are given below:

Table 1: Difference between Transportation System Management (TSM) and Transportation Demand Management (TDM).

Transportation System Management (TSM)	Transportation Demand Management (TDM)
<ul style="list-style-type: none"> <li>○ Coordinated Signal Timing</li> <li>○ Freeway ramp metering</li> <li>○ HOV lanes etc.</li> </ul>	<ul style="list-style-type: none"> <li>○ Commute rideshare matching</li> <li>○ Employer flex time programs</li> <li>○ Congestion Pricing etc.</li> </ul>

Source: RTP of California, 2008.

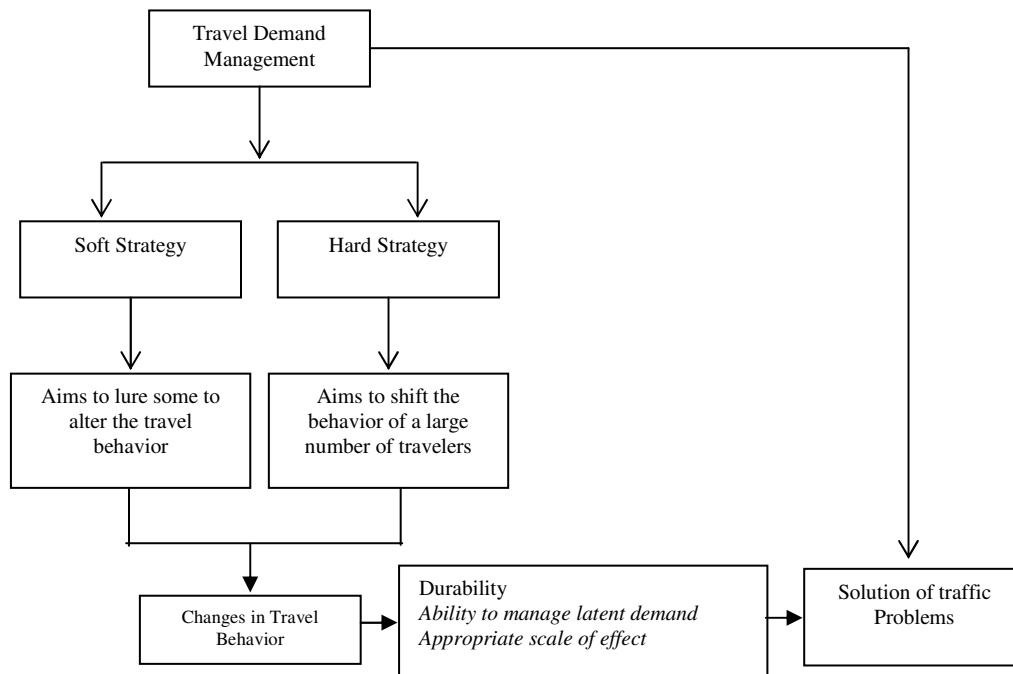
Most transport related projects and actions focus on providing new and improved transport infrastructure, services and operations that affect the supply of transport. Travel demand management is an approach that focuses on travel demand rather than transport supply.

Travel Demand Management (TDM) is a general term for various strategies that increase transportation system efficiency. TDM treats mobility as a means to an end, rather than an end in itself. It emphasizes the movement of people and goods, rather than motor vehicles, and so gives priority to more efficient modes (such as walking, cycling, ridesharing, public transit and tele work), particularly under congested conditions. It prioritizes travel based on the value and costs of each trip, giving higher value trips and lower cost modes priority over lower value, higher cost travel, when doing so increases overall system efficiency (VTPI, 2008).

There are a lot of TDM strategies are present with a diversity of impacts. Some improve the transportation options available to consumers. Some provide incentives to change trip scheduling, route, mode or destination. Others reduce the need for physical travel through more efficient land use, or transportation substitutes. Although most individual TDM strategies only affect a small portion of total travel, the cumulative impacts of a comprehensive TDM program can be significant.

Based on the point of implementation style, TDM strategies are of two kinds: soft strategies and hard strategies.

Soft TDM strategies can be very effective in reducing single-occupant vehicle travel at the scale of an intersection or large employment site, but that the staying power of soft TDM strategies can fade over time. On the other hand “hard” strategies like congestion pricing that shift the behavior of a large number of travelers by changing the price of travel (RTP of California, 2008). The conceptual framework of Travel Demand Management is shown in Figure 1.



Source: [www.vtpi.org](http://www.vtpi.org)

Fig. 1: Conceptual framework of Travel Demand Management (TDM).

Papayioannou and Georgiou (2000) stated that whether the strategy is soft or hard, the main goals of the TDM are to:

- Reduce traffic congestion
- Improve road safety
- Reduce environmental pollution
- Reduce energy consumption

If the strategies are implemented successfully, sustainable transportation system could be achieved easily.

**Strategies**

Till now Travel Demand Management includes more than three dozen strategies that improve transportation options, encourage use of efficient modes, create more accessible land use patterns, and reform biased planning practices.

Table 2: Travel Demand Management Strategies.

Improve Transport Options	Incentives to Reduce Driving	Parking and Land Use Management	Programs and Policy Reforms
Alternative Work Schedules	Walking And Cycling Encouragement	Bicycle Parking	Access Management
Bicycle Improvements	Commuter Financial Incentives	Car-Free Districts & Pedestrianised Streets	Car free Planning
Bike/Transit Integration	Congestion Pricing	Clustered Land Use	Commute Trip Reduction Programs
Car sharing	Distance-Based Pricing	Location Efficient Development	Market Reforms
Flexitime	Fuel Taxes	New Urbanism	Context Sensitive Design
Guaranteed Ride Home	HOV (High Occupant Vehicle) Priority	Parking Management	Freight Transport Management
Individual Actions for Efficient Transport	Parking Pricing	Parking Solutions	Institutional Reforms
Park & Ride	Pay-As-You-Drive Vehicle Insurance	Parking Evaluation	Least Cost Planning
Pedestrian Improvements	Road Pricing	Shared Parking	Regulatory Reform
Ridesharing	Speed Reductions	Smart Growth	School Transport Management
Shuttle Services	Street Reclaiming	Smart Growth Planning and Policy Reforms	Special Event Management
Small Wheeled Transport	Vehicle Use Restrictions	Transit Oriented Development (TOD)	TDM Marketing
Taxi Service Improvements			Tourist Transport Management
Tele work			Transport Management
Traffic Calming			Associations
Transit Improvements			
Universal Design			

Source: Litman, 2004.

### **Transportation System of Dhaka City: Problems and Prospects**

The provision of adequate transport infrastructure and services, along with macro-economic stability and a long-term development strategy is one of the conditions for sustainable development both in the economy as well as in the social situation. However in case of Dhaka, the high level of air pollution, long hours of traffic congestions, poor traffic safety, and presence of non-motorized transport on major roads; all bear the witness to the inadequacy of existing infrastructure facilities, inefficiency in the management of services (Ahsan, 2003).

The situation due to traffic congestion has come to a very critical stage and has already assumed unbearable proportion in Dhaka City. Literally, congestion means a number of things or people crowded together resulting in movement becoming difficult or impossible (Rahman, 2008).

Based on present scenario some principal contributory factors causing the current miserable traffic situation in Dhaka City are identified as follows:

- Excessive ownership of private vehicles
- Lack of enforcement of traffic rules and people are not law abiding
- Poor management of traffic signal lights
- Railway level crossing
- Lack of co-ordination among various transport agencies
- Inadequacy of road network
- Indiscriminate and random parking
- Development of educational institutions in R/A
- Absence of Mass Transit System
- Illegal occupancy of pedestrian way

#### **Excessive Ownership of Private Vehicles**

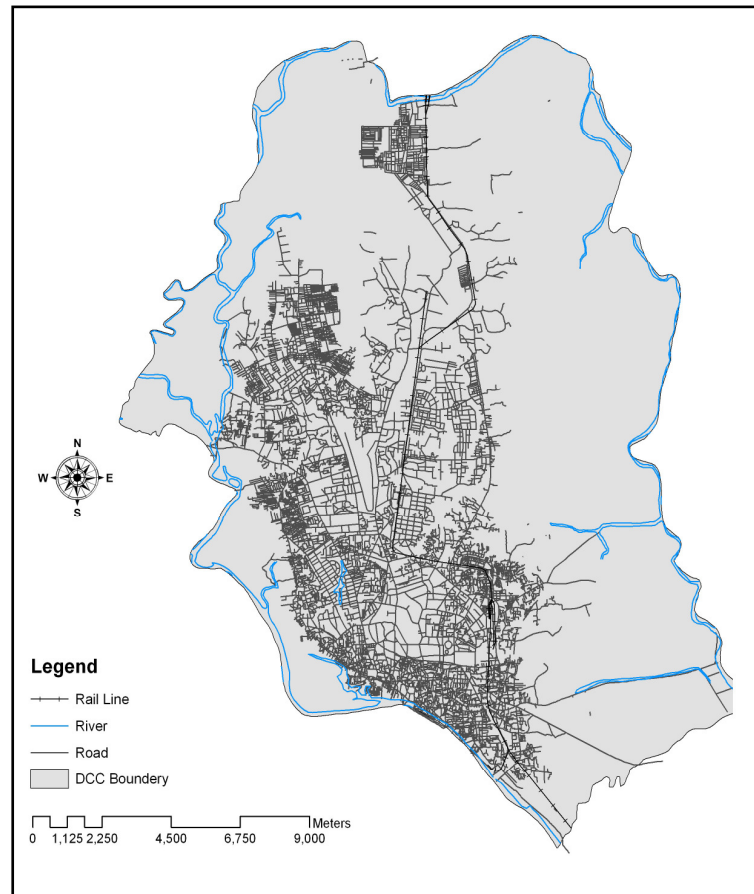
A study by Dargay and Gately (1999) suggests, there is a positive relationship between income and the demand for transportation, both freight and passenger, with the greatest growth in developing countries. This is particularly true for Dhaka city, as increasing disposable income has made private motor vehicles more affordable, leading to increased demand. Every day more than a hundred vehicles are being added to the total. At present most of the cars are driven by natural gas, which is cheaper than traditional car oil. For that's why people are becoming more interested to buy new private vehicles. Up to the year 2003, the total no of vehicles in the city were 303215. But at the end of July' 09 this figure goes up to 508212 in which private vehicles were 411297. (BRTA, 2009).

#### **Lack of Enforcement of Traffic Rules**

Most important problem that could be realized that the people of our country are not law abiding, they do not want to follow traffic rules nevertheless they are forced to follow the rules. Pedestrians show less interest to use footpath, foot-over-bridge or under-pass. Similarly, drivers neither try to follow the traffic rules. Police officials forced them to follow the rules. Moreover, bribery pays a great share in deterioration of overall traffic situation. Traffic polices let the mischief happen on street just for some illegal payments.

### Poor Management of Traffic Signal lights

There are about 1932 nos. of traffic signal lights all over the streets in Dhaka City. The operation and maintenance cost of these lights is about 4 crores Taka (US\$ 0.6 million) (Ahsan, 2003). Poor management and ignorance of the transport authority this modern traffic flow management technique has no use at all, in most of the intersection poor traffic police control the traffic flow manually, because most of the cases the lights are not functioning these days. Recently these damaged lights were identified and repaired to make sure the best use. Moreover due to overflow of traffic these lights couldn't manage them effectively. Due to lack of law abiding intentions of the people most of the intersection are managed manually even Automated Traffic Signal is in operation.



Source: STP, 2005.

Fig. 2: Road network map of Dhaka city

### Railway level Crossing

According to Bangladesh Railway there are 23 authorized railway level crossing in the route of Dhaka to Tongi. In the route of Dhaka-Narayangonj this no is 17. Total no of level crossing is 29 within Dhaka metropolitan area (Kabir, 2004). Daily more than 80 trains pass these crossing between 06am to 11 pm excluding mail trains. On average in every 13 minutes single trains passes these crossings, which spoils more than 06 hours in the 24 hour day. When train

passes through these level crossings long queue of vehicles took place on both sides of the level crossings.

#### **Lack of Co-ordination among Various Transport Agencies**

There are four agencies named DCC, DTCB, DMP and BRTA who are responsible for the management of traffic system of Dhaka city along with RAJUK. But there is no co-ordination among these agencies. As an example, in the month of October DTCB banned movement of rickshaw in few routes of the city to ease the movement of motorized vehicles. But in the real scenario, traffic police denied the effectiveness of that decision (Santonu, 2009).

#### **Inadequacy of Road Network**

Dhaka has only 7 percent of its area for roads while the normal international standard is to have 25 percent (Islam et al, 2001). According to this the total length of road network is 3002 km within the city. Among this only 462 km is available for moving mass transit system and rest are narrow and usable only for light transport. With respect of the number of vehicles, required road is not increasing. For that's why pressure on existing road network is increasing day by day. From existing scenario it is quite clear what will happen in the near future.

#### **Illegal and Random Parking**

Illegal parking is very common affair in the city. Random parking in intersection and commercial areas cause large adverse effects on the efficiency of traffic flow and the effectiveness on the transport system. Even in the high density residential area drivers are use to park their car any where in the road. According to the Motor Vehicle Ordinance, 1983 of the city random parking is a punishable crime and must be stopped. Due to absence of parking policy this affair is continuing and affecting the city transportation system. In DMP ordinance there is provision of penalty for this kind of offence but the authority are not enforcing this due to some problems.

#### **Development of Educational Institutions in R/A**

Most of the private educational institutions are being located in the residential areas of the city. There are 52 private universities in the country in which 42 are located in the various residential areas of Dhaka city like Dhanmondi, Gulshan, Banani, Baridhara, Uttara etc (Karim, 2009). Due to use of private vehicles to commute towards these areas traffic congestion is a daily certainty to the dwellers of these areas.

#### **Absence of Mass Transit System**

The transport sector of Dhaka is composed of both motorized and non-motorized, which use the same road space, resulting in a high level of operational disorder. Dhaka is perhaps the only city of its size without a well organized bus system or any type of mass rapid transit system. The deteriorating traffic conditions are causing congestion resulting in increasing delays. Existing Level of Service of the public transport system is worst than any other countries of the world. On average every vehicles need stop more than 2 minute in every intersection. (Amin and Kabir, 2004)

#### **Illegal Occupancy of Pedestrian Way**

Due to lack of law enforcement most of the pedestrian ways are illegally occupied by hawkers and others. Peoples do not fell safe using these pedestrian ways. According to survey nearly 40% of the footpaths are being occupied illegally (STP, 2005).

### Implemented TDM Strategies around the World

Mobility Management is sometimes criticized for placing unfair restrictions on automobile travel, but this is not necessarily true. Without careful management automobile traffic will regulate itself in an inefficient way, through congestion, parking problems and crash risk. A well-planned Mobility Management plan rations road and parking space more efficiently, and improves travel options, ultimately making everybody better off overall, including people who shift to alternative modes and those who continue to drive (Litman, 2004). Table 3 shows some of the best practices of TDM around the world.

Table 3: TDM strategies implemented around the world.

Technique	Description	Cities/Countries where TDM implemented
Traffic Restrictions for Residential Areas	On-street parking controls, street closures, road humps, elimination of curbs, etc. are used to improve the residential environment	Copenhagen, Netherlands (Harlem, Delft, Enschede), Sweden (Vasteras)
License-Plate Numbering System	Vehicles with odd-numbered plates are not permitted to enter controlled areas on odd numbered working days and Vehicles with even-numbered plates are not permitted to enter on even-numbered days.	Nigeria (Lagos), South Korea (Seoul), Greece (Athens)
Planned Congestion	Capacity restrictions and time delays using traffic signals are applied to achieve planned congestion	UK (Nagoya, Nottingham), Canada (Ottawa )
Traffic Cell System	Division of an urban area into zones which are only mutually accessible by public transportation or by a circuitous route. Pedestrian streets are used to prevent vehicular traffic from passing through an area.	UK (Gothenburg, Besancon, Dijon, Nottingham) Switzerland (Groningen, Delft, Geneva, Nagoya) Canada (Bremen, Ottawa)
Auto-Restricted Zone in CBD	Zones where automobiles are totally eliminated; a new circulation system for buses, pedestrians, taxis and delivery trucks with priority given to buses.	USA (Boston)
Area-Licensing/ Congestion Charging	Vehicles are charged for entering a congested area during peak periods, excluding public and emergency vehicles	Singapore (Singapore City), UK (London)
Vehicles Ownership Restrains	Vehicle ownership is inhibited by high import taxes, purchase taxes, vehicle Registration fees and annual licensing fees.	Hong Kong, Singapore
User Taxes	Vehicle use is restrained through user taxes imposed on fuel, tires, spare parts, etc., thus adding to the	South Korea (Seoul)



	operating cost in relation to the distance traveled.	
Cordon Toll Gates	Tollgates installed at cordons around a controlled area.	UK (Bristol, Bergen, Oslo, Trondheim)
Tolls placed at Particular facilities to control movement	Tollgates are placed at particular facilities, like tunnels and bridges, to control movement.	USA (New York, Southampton), South Korea (Seoul), Hong Kong
Pedestrian Streets	Selected streets are closed to vehicles to promote pedestrian use and safety and a pleasant environment.	UK (London, Nottingham, Liverpool, Leeds, Durham, Coventry), Germany (Mainz, Munich, Stoved, Essen, Stuttgart, Dusseldorf, Hanover, Frankfurt), France (Paris, Besancon), USA (Boston, Minneapolis, Madison, Minnesota, California), Netherlands (Hague Gronigen)
Pedestrian/Bus Street	Pedestrians and buses share road space to reduce traffic congestion and to promote a pleasant environment.	Germany (Trier), UK (Derby, London, Leeds)

Source: Abubakar, 2008.

A well-planned Mobility Management plan helps to achieve efficient and improved travel options, ultimately making everybody better off overall, including people who shift to alternative modes and those who continue to drive.

Congestion pricing in Seoul has been implemented since 1996 in the corridors of two tunnels with a basic charge of about \$1.9. The two tunnels are major southern entrances to the central business district (CBD) of Seoul and experienced severe congestion before the introduction of the congestion pricing scheme. One year after the implementation of the scheme, traffic volume passing through the two tunnels decreased by 13.3%, thus proving the effectiveness of the scheme. (Ko and Choi, 2007).

In Athens a project named TRANSPRICE was introduced to assess user response and behavioral, financial, environmental and energy impacts of demand management and mode choice related Trans modal pricing measures including urban road pricing. The real life demonstration results indicate that up to 15% of car drivers transferred to park and ride with a 5:1 pricing regime in favor of park and ride. Demand for all modes travel-card has established at about 10% of all public transport ticket sales (Papaioannou and Georgiou, 2000).

Due to overflow of private vehicles traffic congestion reached in a critical situation in the CBD area of London. To solve this problem authority introduced cordon charging in the CBD area. After the proper implementation of congestion charging, overall congestion decreased by about 30%, weekday speeds in/around zone grew by 10 – 20% and NOx, PM emissions down 13-15% in zone. Public Buses were benefiting from reduced congestion and for that's why bus reliability increased to 25% and peak hour bus speed rose to 20% (Replogle, 2008).

Manual road pricing was introduced in Central Business District (CBD) of Singapore city since 1975. This project was known as Area Licensing Scheme (ALS). Electronic Road

Pricing (ERP) was introduced in 1998. Area Licensing Scheme reduced 31-44% traffic congestion and Electronic Road Pricing reduced 10-15% traffic congestion from CBD area of the city (Tsuiji, 2006).

In Sao Paulo, each weekday during peak hours 20% of the vehicle total private vehicles are not allowed to enter in the CBD area. To decrease this volume the city authority implemented Vehicle Use restriction in the CBD area. This project cut CO level 12%, decreased congestion by 20% (Walter and Eric, 2004).

The benefits of both car sharing and unbundling in reducing parking demand and car use are well documented. Recent U.C. Berkeley studies found that between 24% and 29% of City Car Share members have sold a car in the past two years. These benefits have been confirmed by studies in cities such as Philadelphia and Chicago, as well as national surveys. And although research is scarcer, unbundling can reduce parking demand by as much as 30% (Anton, 2008).

The improvement of air quality in Bangkok is attributed to the introduction of various synergistic policies and strategies since the late 1990s. Along with the land use and urban planning policies TDM measures helped Shifting from leaded to unleaded gasoline in Thailand, and fully phased out in 1995. This program has contributed to the purity of urban air quality by diminishing toxic substance from the air (Perera, 2000).

### **Applicable TDM Strategies for Dhaka City**

TDM has been considered particularly appropriate in developing countries to overcome their urban transportation problem. Commuters in developing nations or regions are forced to depend mostly on affordable transportation options including walking, cycling, animal power, ridesharing, transit which usually require less money. Therefore, the positive effect derived from transportation cost savings and efficiency will be more dominant in developing countries than developed countries. It implies that TDM strategy that facilitates lower-cost travel options will be useful for a larger portion of residents in developing than in developed regions (Litman, 2004).

The following are the explanation of different types of TDM measures that have been widely acknowledged by the transport planners and policy makers across the world, which could be very much effective in solving identified transportation problems of Dhaka City.

#### ***a. Alternative Work Schedules***

The alternative Work Schedules (also called Variable Work Hours) include:

**Flextime:** This means that employees are allowed some flexibility in their daily work schedules. For example, rather than all employees working 8:00 to 4:30, some might work 7:30 to 4:00, and others 9:00 to 5:30.

**Compressed Workweek (CWW):** This means that employees work fewer but longer days, such as four 10-hour days each week (4/40), or 9-hour days with one day off every two weeks (9/80).

**Staggered Shifts:** This means that shifts are staggered to reduce the number of employees arriving and leaving a worksite at one time. For example, some shifts may be 8:00 to 4:30, others 8:30 to 5:00, and others 9:00 to 5:30. This has a similar effect on traffic as flextime, but does not give individual employees as much control over their schedules (VTPI, 2008).

It's been observed that the most of the educational, commercial and other institution's starting and closing time is in same time. It creates a lot of pressure on the movement of people. If these times are rescheduled properly then these overpressure could be eased in different time. Recently the govt. has set new timing for non-govt. offices and educational institutions. But this initiative failed to achieve its goal. Entering the new time zone without doing any detailed

study stretched the traffic jam throughout the day. This initiative could be a very much helpful for the movement of vehicle on the roads if the reschedule is done after proper study.

#### ***b. Car Sharing***

Car sharing refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable, even for low-income households, while providing an incentive to minimize driving and rely on alternative travel options as much as possible (VTPI, 2008).

The average occupancy in the private vehicles is really low in the city. People like to travel on his vehicles without sharing it with others. Promotion of High Occupancy Vehicle (HOV) lane could an indirect measure to improve the car sharing option. As an example no one will be allowed to use the HOV lane if the car occupancy is two excluding driver. High ranked officials travel alone in the private vehicles. If he/she travels with some of his officers then it could remove some of the private vehicles from the street.

#### ***c. Congestion Pricing***

The basic principle is that where and when a commodity is most scarce, its use should be curbed through increased prices that will lower the demand of the commodity in that place and time. Therefore, congestion pricing could be charged for discouraging the people not to use their own vehicles. This type of pricing has the potential to reduce the need for new highway capacity, improve air quality, relieve peak traffic congestion, increase the use of high-occupancy vehicles, reduce automobile use in highly congested urban environments, raised revenue for much needed transportation improvements, and establish a rational pricing system following sound economic principles (Zupan, 1992).

Congestion pricing are charged to discourage driver to use certain roads. This policy could be very much helpful in the roads of CBD area of the city. The users should pay for using these busy roads. During the peak period in the Motijheel area most of the roads becomes gridlock due to excessive pressure of vehicles. If congestion pricing is in place then this volume will decrease and the roads will be more convenient for the movement of people. Congestion pricing could be implemented not only for Motijheel but also for other important roads of the city.

#### ***d. Parking Management***

Parking management through parking pricing is one of the most effective TDM strategies. This approach could emphasis on free using of a parking close to office building by carpoolers and vanpoolers while short occupancy vehicles (SOVs) pay for parking. Another approach is paying each employee a transportation benefit while charging for parking at the site so that people who use walk, bike or pool can save this benefit while SOV users pay for parking (Zupan, 1992).

Parking policies and pricing is frequently viewed as either a complementary or competing force with TDM, depending upon their use. In Dhaka, there are very few areas that charge for parking but the rate is too cheap. These conditions tend to lead to an increase in automobile use by visitors and employees compared to other areas of the city that charge for parking. Illegal parking often causes congestion and parking management can be an effective measure to solve the problem as well as to raise revenue.

#### ***e. Vehicle Use Restrictions***

Vehicle Restrictions usually include various exemptions. For example, certain types of vehicles may be allowed in car-free areas or be exempted from no-drive days. Such exemptions may be controversial because those who qualify sometimes abuse their privileges. For example, if vehicles used by people with disabilities are allowed to drive in car-free areas,

people may exaggerate a minor disability to quality, and those who have such vehicles may lend them to able-bodied friends (VTPI, 2008). One of the most well known restrictions is the even odd numbering of the vehicles. Congested areas could use this policy to reduce the number of traffic in certain days.

***f. Walking and Cycling Encouragement***

Bicycle and Walking Encouragement include a variety of programs and activities that support and promote nonmotorized transportation. These programs can help increase nonmotorized transportation. Travel impacts tend to be greatest during a particular campaign, but the experience can lead participants to long-term changes in travel habits (VTPI, 2008).

Due to poor condition of pedestrian ways most of the commuters except garments worker are not likely to walk. Moreover safety is also another concern. Pedestrian friendly walk ways will encourage the city people to walk shorter distances rather than use a vehicle.

***g. Fuel Taxes***

A gradual reduction in and ultimate elimination of fuel subsidies should result in monies that can be channeled towards improving the reach and connectivity of public transportation networks and subsidies for the cost of public transportation fares (Kasipillai and Chan, 2008).

Every year govt. pays a huge amount of subsidy in the fuel sector. At present availability of gas in the city area are also influencing city dwellers to own a private vehicle. To restrict the no of private vehicle the govt. should reduce the amount of subsidy from this sector, but we also have to consider the importance of fuel in agricultural sector.

***h. Land Use and Zoning***

The density, location and type of developed land determine how people will travel. Residential and employment densities above certain levels are necessary to support public transit (Zupan, 1992).

Land zoning regulations should include those transit friendly concepts to induce the people to shift toward transit, bicycling, and walking. Educational institutions should not be permitted in the residential or commercial area. Moreover decentralization is must to the betterment of the city.

***i. Institutional Reform***

Institutional Reforms are changes to transportation organizations' policies and practices to support TDM implementation. This involves expanding by expanding the range of options considered in transport planning to include demand management strategies, and changing the methods used to define problems and evaluate solutions (VTPI, 2008).

At present there is lack of coordination among various transport agencies of the city. Change in the policy and practices in the organization constitution could solve this problem easily and lend toward better transportation services.

***j. Regulatory Reform***

Regulatory Reform involves changing motor carrier and taxi regulations to encourage competition, innovation, diversity and efficiency in the provision of transportation services. Many jurisdictions have rigid restrictions on transportation services. Firms attempting to introduce a new transportation service, such as commuter express buses, Shuttles and Jitneys or shared taxies, often prohibited altogether or face excessive regulation. Taxi service is often highly regulated in ways that limit consumer choice and affordability (VTPI, 2008).

At present taxi services are in grave danger due to lack of proper initiatives of the govt. Most of the time passengers are facing mugging, robbery in the taxi services. With the promotion of interactive packages and well management system taxi service could provide a great support to the existing transportation system.

***k. School Transport Management***

To avoid traffic congestion, students should use school/college bus rather than private cars. Already BRTA initiated to provide 200 buses among the various schools of the city. Hopefully this will help to reduce congestion in residential areas.

***l. Tele Work***

Tele work is a general term for the use of telecommunications (telephone, fax, email, websites, video connections, etc.) to substitute for physical travel. Telecommuting is usually implemented in response to employee demand or as part of a Commute Trip Reduction program. Other forms of tele work and other applications of telecommunication are implemented by businesses and government agencies to improve services, reduce costs, reduce vehicle travel or help achieve other objectives. In our country this system is already in place. People can pay their bills through mobile phones rather traveling to the banks. Moreover we can buy tickets or apply to the jobs through mobile phones, not going there physically. Few companies are trying to sell their products through internet. Some well known sites are: [www.haatbazar.com](http://www.haatbazar.com), [www.bengalcommerce.com](http://www.bengalcommerce.com), [www.emrex.com](http://www.emrex.com), [www.bdjobs.com](http://www.bdjobs.com), [www.cellbazar.com](http://www.cellbazar.com) etc. These will help to reduce the number of trip for small works.

***m. Pedestrian Improvements***

Pedestrian facilities (sidewalks and paths) must accommodate many uses and types of users. People walk alone, in groups, walk pets, push strollers and carts, run, skate, stop to gaze and talk, play and eat on sidewalks and paths. Many paths also accommodate scooters and bicycles. Different uses and users require different amounts of space. Although a person walking alone may only need 18-24 inches of width, other users and uses require more space (VTPI, 2008).

In Dhaka city, about 60% trips are being made on foot (STP, 2005) but the pedestrians are facing many problems while using the walkways. Most of the commuter are garments worker and low income people. Due to their economic condition they move along these footpaths though they are unsafe. Others do not feel safe and comfortable to use pedestrian way because of the poor condition of these walkways. If the pedestrian ways are developed, more people will be interested to walk short distances rather than using private vehicles. This will save both time and money for the residents of Dhaka city.

***n. Altering Charges on Road Taxes and Car Insurance***

Altering the charging of both road tax and car insurance from a fixed yearly cost to a per-journey payment is a way of applying the Polluter Pays Principle (PPP). On the face of it, given millions of vehicles on the road, this step is an administratively tedious task, but the government already has the infrastructure in place for its implementation: odometer audits via its inspection and maintenance network or full electronic payment schemes such as those currently partially implemented for tolled roads. (Kasipillai and Chan, 2008)

BRTA collects an annual registration fee that varies with the number of seats in the vehicle (e.g. BDT 4,500 for a regular size car; BDT 6,000 for a medium size van). This is too small and people are buying more private vehicles for low maintenance cost. The people who are already having car should be discouraged by imposing more charges and that will help to

reduce the number of cars. As per the described strategies, the traffic problem solution structure of Dhaka city could be drawn as follows:

Table 4: TDM Strategies based on problems

Problem	TDM Measure
Excessive ownership of private vehicles	<ul style="list-style-type: none"> <li>▪ Vehicle use restrictions</li> <li>▪ Congestion Pricing</li> <li>▪ Parking management</li> <li>▪ Fuel taxes</li> <li>▪ Car Sharing</li> <li>▪ Altering charges on Road taxes and Car Insurance</li> </ul>
Lack of enforcement of traffic rules and people are not law abiding	<ul style="list-style-type: none"> <li>▪ Institutional reform</li> <li>▪ Regulatory reform</li> <li>▪ Parking management</li> </ul>
Poor management of traffic signal lights	<ul style="list-style-type: none"> <li>▪ Transit improvements</li> </ul>
Railway level crossing	<ul style="list-style-type: none"> <li>▪ Transit improvements</li> </ul>
Lack of co-ordination among various transport agencies	<ul style="list-style-type: none"> <li>▪ Institutional reform</li> <li>▪ Regulatory reform</li> </ul>
Inadequacy of road network	<ul style="list-style-type: none"> <li>▪ Transit improvements</li> <li>▪ Tele work</li> <li>▪ Congestion pricing</li> <li>▪ Parking management</li> </ul>
Illegal and random parking	<ul style="list-style-type: none"> <li>▪ Parking management</li> <li>▪ Car sharing</li> <li>▪ Congestion pricing</li> </ul>
Development of educational institutions in R/A	<ul style="list-style-type: none"> <li>▪ School transport management</li> <li>▪ Land use and zoning</li> <li>▪ Car sharing</li> </ul>
Absence of Mass Transit System	<ul style="list-style-type: none"> <li>▪ Parking management</li> <li>▪ Transit improvement</li> </ul>
Illegal occupancy of pedestrian way	<ul style="list-style-type: none"> <li>▪ Pedestrian improvements</li> <li>▪ Walking and cycling encouragement</li> </ul>

Source: Author, 2010

Individual TDM strategies tend to provide modest but multiple benefits, and so are not usually considered the best solution to any single objective. Conventional transportation evaluation practices that focus on individual problems tend to undervalue TDM solutions. They tend to

favor technical solutions are effective at reducing one or two problems, although they often exacerbate others due to Rebound Effects. For example, adding capacity may reduce traffic congestion on a particular highway, but it can increase downstream traffic congestion, parking problems, crashes, environmental impacts, and urban sprawl. Conversely, fuel efficiency standards and alternative fuels that reduce vehicle operating costs encourage increased driving, which can increase traffic congestion, road and parking facility costs, crashes, sprawl and even some types of pollution. Following matrix shows the identified problems of Dhaka city are solved based on strategies.

Table 5: Impact evaluation of TDM

Objective	Widen Existing Roads	Fuel Efficiency Standards	TDM Strategy
Congestion Reduction	+	-	+
Road & Parking Savings	-	-	+
Consumer Savings (vehicle costs)			+
Transport Choice			+
Road Safety	-	-	+
Environmental Protection	-	+	+
Efficient Land Use	-	-	+
Community Livability	-		+

Note: + = supports objective. - = contradicts objective

Source: VTPI, 2008.

### Conclusion

Eventually, Dhaka becomes an auto reliance city with the traffic congestion extended over larger areas for a longer period of days and resulting in substantial social, environmental, and economic costs. Transport planning and development in Dhaka should, therefore, carefully consider the potential future role of Travel Demand Management type measures and how to sustain their effectiveness, within the context of changing economic condition. For example, the transition from the current situation in which people, who for economic reasons are forced to use poor quality bus services, to a future situation in which people use high quality bus and mass rapid transit services as a matter of choice is important. The transition from the current situation in which people, some of whom for economic reasons are forced to endure poor quality pedestrian facilities while others avoid walking altogether, to a future situation in which people enjoy walking on good quality safe pedestrian walkways as a matter of choice is also important. The point is one of deciding to manage such transitions, rather than waiting for it to happen.

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