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TRAFFIC CONGESTION: A MAJOR ROAD NETWORK PROBLEM IN UDAIPUR CITY

Dr. Sabiha Khan
Guest Faculty , Department of Geography, U.C.S.S.H., M.L.S.University, Udaipur.

ABSTRACT

In recent decades urban areas have expanded rapidly. As a result growth in number of vehicles and increase in traffic movements, the current level of congestion is growing day by day, and the future volume of traffic is expected to increase. Congestion can generally be defined as express demand for road travel. Supply of road travel infrastructure is not sufficient to meet demand levels during peak times to a given level of service.

Udaipur city is not only a major tourist spot but also rising as an industrial and educational centre in state of Rajasthan. Inadequate road network, proliferation of traffic and lack of parking places are major factors for recurring congestion at particular points in the network. Inadequate public transport facilities and management etc. increase the problem of congestion.

It is therefore, crucial to investigate new technologies and alternative methods of traffic management to reduce congestion without increasing road space particularly in city core. In the proposed study, places and causes of congestion has been identified through network connectivity and nodal accessibility and existing road network. The study serves better solutions and possibilities to solve the existing problem of traffic congestion

KEY WORDS: *Road Network, Traffic Congestion, Traffic Management.*

INTRODUCTION

Traffic congestion means there are more people trying to use a given transportation facility during a specific period of time than the facility can handle with what are considered to be acceptable levels of delay or inconvenience.

Recurrent Congestion- Traffic congestion can seen regularly during peak traffic periods, when travel demand is high (e.g. morning and afternoon commute). Non Recurrent Congestion- It occurs when something unusual and unexpected happens to reduce available road capacity(e.g. weather, construction, road accidents, etc.).

Transportation is an important aspect of human civilization as it reflects the economic level and technological advancement of a given society. Traffic congestion in urban areas is often the outcome of successful urban economic development, employment, housing and cultural, policies that make people want to live and work relatively close to each other and attract firms to benefit from the gains in productivity thus derived. Road transport enables access to social activities, employment, health care, education, etc. The level of access is determined by various factors including travel time and reliability. As congestion impacts on

travel time and reliability it reduces accessibility.In recent decades urban areas have expanded rapidly. The current level of congestion is growing day by day, and the future volume of traffic is expected to increase. However, the fact that cars has brought freedom, flexibility and mobility to many people cannot be overlooked, but there is increasing concern about the health and environmental effects of pollution from congested traffic. The same forces that draw inhabitants to congregate in large urban areas lead sometimes to intolerable levels of traffic congestion on urban streets and thoroughfare. Also, rising incomes combined with an increasing propensity from personal mobility and inadequate mass transportation on facilities has resulted in a pronounced increase in automobile ownership and its utilization in major cities. The emergence of traffic and subsequently traffic congestion has opened up the need for improved traffic flow to ensure reduced travel time, safety, average fuel consumption and healthy environments. Traffic congestion occurs when there is excess demand on a highway or road,or when the actual number of vehicles on the road is greater than the capacityof that road to maintain effective traffic flow. Slow speeds, longer trip times,and increased queuing of vehicles characterize traffic congestion (Altshore,1977). According to Cervero (1991) and Downs (1992) road traffic congestion is a major urban transport problem. Increasing demand for travel will compound the problem if appropriate solutions are not actively sought. Efficient public transport (PT) can be one of the potential solutions to the problem of urban road traffic congestion (Vuchic 1999, Hyman and Mayhew 2002,;Pucher et al. 2007;).Congestion can generally be defined as excess demand for road travel Supply of road travel infrastructure is not sufficient to meet demand levels to a given level of service. As a consequence, travel speeds fall and delays are explained. This general definition of congestion implies that it can be measured in various ways. Average speed, flow/density, delay and travel time variability can all be used to assess the level of congestion. Congestion prevents traffic from moving freely, quickly and/or predictably (Organisation of Economic Co-operation and Development (OECD), 2006). Ian W.H. Parry (2008) -presented the optimal design of pricing policies to reduce urban automobile congestion.Urbanization, according to Armah, Yawson and Papson (2009) noted a myriad challenges to transportation system in relation to negative extremity such as traffic congestion and environmental risk. Azeem Uddin(2009) - discussed on the problem of road congestion and presented technical solutions i.e. use of traffic engineering, transportation management, and traveller information tools. Awosusi, AjokeOlukemi(2010) worked on Urban Traffic Congestion and Its Attendant Health Effects on Road Users in Ado-Ekiti, Nigeria. It looked critically at the problems, causes and possible remedialmeasures to urban traffic congestion within the study area.MdAftabuzzaman, Graham Currie, Majid Sarvi(2010) presented a comparative assessment of international research valuing the congestion relief impacts of Public Transport.

It is therefore, crucial to investigate new technologies and alternative methods of traffic management to reduce congestion without increasing road space particularly in city core. In the proposed study, places and causes of congestion has been identified in the existing road network of the city. The study serves better solutions and possibilities to solve the existing problem of traffic congestion.

STUDY AREA

Udaipur city is located at 24° 35’ N latitude and 73° 42’ E longitude at a distance of nearly 122 kms north of tropic of cancer and 577 meters above M.S.L. surrounded by hills and drained by river Ahar. Udaipur city is major tourist, industrial and educational centre in state of Rajasthan. The road system of the city is linked with the external system. The National Highway No.8 serving Delhi, Haryana, Rajasthan and Gujarat passes right through the city in the north-south direction. Three State Highways connect the city with four nearest district headquarters namely Jodhpur, Sirohi, Chittorgarh and Banswara in the west, south-west, and north-east and south direction respectively. The city is not well settled city because of its unsettled formation of roads and inadequate road network. Problem of congestion is increasing day by day as a result of increase in traffic. In the city 1105 acre land is under transportation, which is 11.18% of the developed area and 4.89% of total urban area. . The municipal area of the city is 61.10 sq. Kms.

OBJECTIVES

- To analyse the problem of congestion in the existing road network of the city.
- To identify the factors associated with congestion on major routes and junctions of the city.
- To serves better solutions and possibilities to solve the existing problem of traffic congestion.

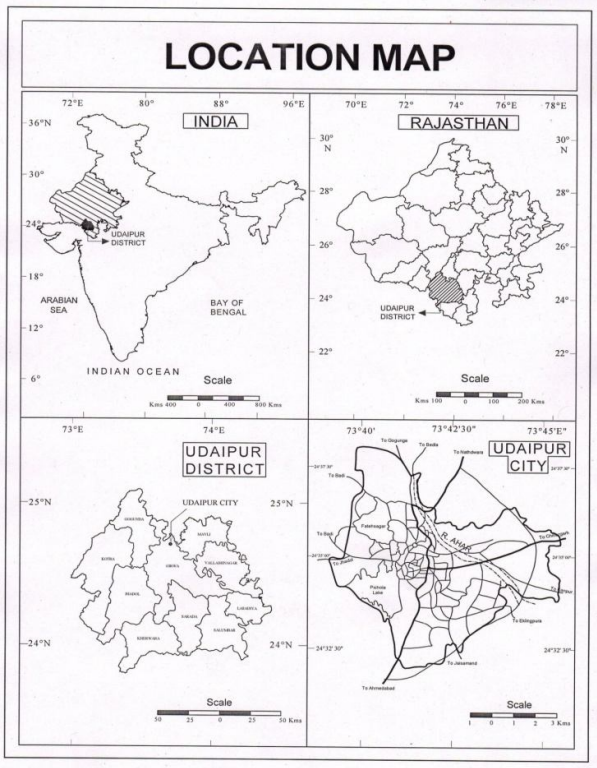

Figure. 1

METHODOLOGY AND SOURCE OF DATA

Arterial, sub arterial roads and bottlenecks of existing road network obtained from Traffic and Transportation Master Plan, Udaipur City. Road network characteristics responsible for traffic congestion on major routes and nodes of the city have been collected through field survey. Data of traffic volume at different junctions and noise pollution have been obtained during peak hours of weak days and signal timing at major junctions of the city have been obtained through primary survey.

RESULT AND DISCUSSION

The endemic and unpredictable traffic congestion degrades the quality of daily life in the city. Rapid growth in number of vehicles and a mixed incompatible mode of slow and fast traffic is causing congestion.People not using public transport - either because it is less convenient, too expensive or not available. Public transport buses and ride sharing auto-rickshaws are available on selected routes. The vehicular population is growing almost in geometric progression and the share of two- wheelers in the total vehicular population is increasing by leaps and bounds, which is % of total vehicles registered in the city (Table 1).

Table 1: Registered Motor Vehicles in Udaipur

Year	Two-Wheeler	Passenger Vehicle	Light Motor Vehicle	Heavy Motor Vehicle	Others	Total
2003-04	15610	446	2684	1669	45	20454

2004-05	16219	351	2855	1274	-	20699
2005-06	19399	531	3553	1477	20	24980
2006-07	24288	579	3426	2986	104	31383
2007-08	24576	775	5366	3300	129	34146
2008-09	26123	643	5406	2246	132	34550
2009-10	26678	626	5406	2501	92	35303
2010-11	34463	815	6964	3194	97	45533
2011-12	38873	960	7352	3505	150	50840
2012-13	41590	1161	7304	3294	172	53521

CITY HAS BEEN DIVIDED INTO TWO MAJOR PARTS-

Walled City- The road system of walled city is, in many ways different from the one existing outside the walls. . The region having inadequate road network with narrow width of roads and so many bottlenecks. The width of roads in walled city is not more than 5-20 feet and it is only a meter or so at many places. Roads are narrow, crooked, undulating and having eccentric pattern. The region is most densely populated under residential, commercial, touristic land use. Two or three storey buildings on these roads have no proper space for parking in their residents. Most of them have been converted in other categories such as shops, guest houses, hotels and touristic market. Road side parking is better options for consumers, where parking places are not providing by owners of these categories. Road side encroachments by hawkers, vegetable sellers, cattle's and parked vehicles are other major factors of congestion in walled city. In this part of the city, the problem of congestion exaggerates at school time, construction or repairing work and loading and unloading of goods. The problem reaches to its peak during marriage and tourist season.

Hathi Pol, Delhi Gate, Suraj Pol, Udai Pol are major junctions located on the periphery (Kot) of walled city. These junctions are most accessible nodes of the city road network through which traffic from outer part enters in the walled city. Excess load of vehicular traffic, road side encroachments, mismanagement of traffic and unawareness of traffic rules are major problems on these junctions. Inadequate road network such as lack of parking places, pedestrian tracts and subways and mismanagement of traffic like lack of segregation of traffic and one ways, poor signal timings and breaking of traffic rules are responsible factors of congestion at major junctions. Improper functioning of traffic signals is a cause of great worries. There is however, a bigger issue that needs to be handled, road traffic management affected by poor functioning of signals. Until this issue is addressed, road users will continue to experience severe delays during their travels and pedestrians will remain at risk when crossing busy roads. Air and noise pollution are another major problem of walled city occurred due to congestion.

Table No. 2: Volume of Traffic at major junctions of the city (With signal timing)

S.N.	Junction	From	Time for cross (In sec.)	Awaited Time (In sec.)	Two Wheeler	Three Wheeler	Four Wheeler
1	Suraj Pol (per turn)	Udai Pol	35	69	60-65	35-40	35-40
		Rang Niwas	17	87	45-50	15-20	10-15
		Delhi Gate	35	69	40-45	55-60	40-45
		Thokar Chouraha	17	87	45-50	25-30	15-20
		TOTAL	104	-	190-210	130-150	100-120
2.	Delhi Gate (per turn)	Suraj Pol	35	80	65-70	35-40	35-40
		Bapu Bazaar, Dhanmandi	20	95	45-50	20-25	15-20
		Hathi Pol	15	100	40-45	55-60	20-25
		Shastri C.&Court C.	20	85	70-75	25-30	20-25

		TOTAL	90	-	220-240	135-155	90-110
3.	Chetak Circle (per turn)	Hathi Pol	20	50	25-30	15-20	15-20
		Court Circle	20	50	30-35	10-12	10-12
		Fateh Sagar	15	55	20-25	5-10	5-10
		Sukhadia Circle	15	55	20-25	15-20	10-12
		TOTAL	70	-	95-115	45-62	40-54
4.	Court Circle (per turn)	Shastri Circle	19	57	35-40	5-10	15-20
		Chetak Circle	19	57	30-40	5-10	10-12
		Delhi Gate	19	57	35-40	15-20	10-12
		M.G. College	19	57	20-25	5-10	5-10
		TOTAL	76	-	120-145	30-50	40-54

Source: Field Survey -2016

Above table no.1 presents load of traffic and signal timing at major junctions of the walled city. At Surajpol and Delhi Gate junctions signal timing is not adequate according to flow of traffic (volume). It creates recurrent congestion for whole day. Volume of traffic at other junctions of the city has shown in table no. 2. Traffic signal is not available on these junctions, which creates mismanagement and congestion.

Table No. 3: Volume of Traffic at other major junctions of the city

S.No.	Junction	From	2-Wheeler	3-Wheeler	4-Wheeler
1.	Shastri Circle (Per min.)	Delhi Gate	40-45	20-25	15-20
		Ashok Nagar Road	60-70	20-25	20-25
		Court Circle	30-35	25-30	20-25
		M.G. College	25-30	10-15	15-20
		TOTAL	155-180	75-95	70-90
2.	Udai Pol (Per Min.)	Suraj Pol	40-50	20-25	15-20
		Saveena	25-30	10-15	10-15
		G. Villas	30-40	15-20	10-15
		Gulab Bagh	25-30	10-15	10-15
		TOTAL	120-150	55-75	45-65
3.	Hathi Pol (per minute)	Ashwini Market	45-50	20-25	10-15
		Chetak Circle	40-45	15-20	5-10
		Ghantaghar	30-40	5-10	5-10
		Jharia Marg	10-15	5-10	0-5
		TOTAL	125-150	45-65	20-40

Source: Field Survey-2016

Table No. 4: Level of Noise Pollution during Peak Hour in Udaipur City

S.No.	Location	Minimum Value	Maximum Value
1.	Chetak Circle	60 db	75 db
2.	Court Circle	70 db	78 db
3.	Delhi Gate	75 db	90 db
4.	Hathipol	60 db	75 db
5.	Shastri Circle	70 db	80 db
6.	Surajpol	77 db	90 db
7.	Udaipol	80 db	90 db

Source: Field Survey-2016

Outside Walled City- Outer part of the walled city has adequate road network with rectilinear pattern of roads. New developed residential, commercial and educational sectors having proper parking places. End nodes located on the periphery of the city boundary, through which vehicular traffic of other rural and urban areas enter and merge with the city traffic. Maximum number of road accidents and fatalities recorded on these nodes because of lack of over bridges, road lights and traffic signals. In last decade approximate 80% of fatalities recorded at Goverdhan Villas bye pass, Pratap Nagar bye pass and Ambamata. Bottlenecks and road side encroachments on arterial roads are responsible factors for occurrence of congestion and road accidents.

There are so many factors associated with congestion on arterial and sub arterial roads are given in below tables.

Table No. 5: Arterial Roads of the City

S. No.	Route	Bottleneck Point
1	Udaipur-Ahmedabad	Goverdhan Villas
2	Udaipur-Banswara	Saveena
3	Udaipur-Chittorgarh	Debari , Pratap Nagar and Sunderwas
4	Udaipur-Jaipur	Pulan and Bhuwana
5	Udaipur-Jhadol	Sisarma
6	Udaipur-Ranakpur	Badgaon

Source: Traffic and Transportation Master Plan, Rajasthan Govt.

Table No. 6:Sub Arterial Roads of the City

S.N	Route	Distance (In KMs)	Width (Feet)	Divider/ Cuts	Junctions/ Signal P/A	Features of Congestion
1	Fatehpura-Sukhadia Circle	1.0	80 Feet	Present 3	_	Bus stoppage at Fatehpura. Merge of traffic at junction.
2	Sukhadia Circle Chetak Circle	1.2	80 Feet	Absent	_	Ayad bridge(bottleneck)
3	Chetak Circle - Hathipol	0.7	80 Feet	Absent	_	Road side encroachments.
4	Chetak Circle Shastri Circle	1.2	100 Feet	Present 3	Court Circle (Present)	Road side encroachments on hospital road. absence of divider
5	Hathi Pol-Shastri Circle	1.5	80-100 Feet	Absent	Delhi Gate (Present) Court Cir. (Present)	Absence of divider and road side encroachment at Ashwini Market. Encroachment and Heavy rush at Delhi Gate junction. Mismanagement of traffic at junctions.
6	Hathi Pol-Jagdish Mandir	1.2	20-40 Feet	Absent	Ghantaghar (absent)	Narrow width of roads. Whole route

						congested by road side encroachments.
7	Delhi Gate-Suraj Pol	0.8	80 Feet	Present 01	_	Heavy rush on Town Hall road. Road side encroachment by auto-rickshaw at Suraj Pol.
8	Suraj Pol – Udai Pol	0.55	80-100 Feet	Present 1	_	Road side encroachments by vehicles, specially by private buses. Mismanagement of traffic.
9	Udai Pol-G.V.Bye Pass	6.0	80-100 Feet	Present 28	Patel Circle (Absent) Paras Tiraha (Present)	Bottleneck at G.V.residential area. Non working Light system and encroachment by vegetable and fruit sellers at Paras Tiraha.
10	Sevashram-Paras	6.2	80-100 Feet	Present 27	Reti Stand (Absent)	Road encroachment by trucks at Reti stand and Krishi Upaj Mandi.
11	M.L.S.U. Shastri Circle	3.7	80 Feet	Present 20	Sukhadia Memorial (Present)	Bekni Pulia, Ayad bridge (bottleneck). Merge of traffic at ayad bridge and Shakti Nagar Chouraha. Mismanagement of traffic at Sukhadia Memorial.
12	Pratap Nagar Bye Pass-Suraj Pol	5.3	100 Feet	Present 40	M.B.College (present) Sevashram (present) Thokar (Absent)	Heavy traffic rush. Merge of traffic and road side encroachment by vegetable sellers near railway station. Mismanagement of traffic at junctions.
13	Shastri Circle-Sukhadia Circle	2.1	60-80 Feet	Uncont.	M.G.College	Ayad bridge, Bhupalpura turn (bottleneck). Mismanagement of traffic .

Source: Field Survey-2016

CONCLUSION AND SUGGESTIONS-

This research concludes that inadequate road network, proliferation of traffic and lack of parking places are major factors for recurring congestion at particular points in the network. While, inadequate

public transport facilities and management etc. exaggerate the problem of congestion. Due to vehicular congestion level of air and noise pollution increased in the walled city, while road accidents occurred at major junctions and peripheral nodes of the city.

Walled city and major junctions of the city at peripheral location having recurrent congestion, while arterial roads, sub arterial roads and end nodes of the city having a problem of non- recurrent congestion.

SOLUTION AND SUGGESTIONS:

The improving-infrastructure approach seeks to accommodate the future. What is also needed is a preventive approach to actually reduce the traffic on the roads. This can be achieved by following steps:

Improve road network:

- Proper maintenance and widening of roads.
- Provision of service roads and proper alignment of roads.
- Construction of new roads, fly-over and over bridges.
- Built adequate foot paths and sub ways for pedestrians.
- Bottlenecks must be removed on the roads.
- Busy intersections must be remodelled.
- There should be proper road dividers on arterial roads with significant cuts.

Proper land use:

- There should be proper land under transportation and reserve adequate land for future transportation planning.
- Owners of residential houses should not be permitted to convert their land into any other category.
- Schools, hotels and shopping complexes at congested areas and road side vegetable markets Should be transferred at proper place.
- There should be planned parking places and bus stoppages in the city.

Reduce traffic on roads:

- Introduce car free zones in C.B.D.
- On street parking of vehicles, encroachments should be banned strictly.
- Road pricing on arterial roads by applying ANPR system and OCR techniques.
- Build better public transport facilities in the city.
- Encourage sharing vehicles for the common trip. Ridesharing ca involve carpooling, vanpooling and bus pooling.

Traffic control system:

- Intersection traffic control devices should se improved. These devices include stop signs, traffic signs and turning lanes.
- Conflicting traffic at intersections, this helps in increase the capacity of road network.
- The measures like designating one way streets and banning the conflicting turns.
- Installation of traffic signs and signals and road marking is also important.
- One way traffic regulations should be adopted in heavy traffic areas of C.B.D.

Awareness Programmes:

- These programmes should be introduced by NGOs, media, government and private sectors.
- Campaign programmes especially for school students should organised.
- Road safety week and licence camps should conducted timely by government.

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Dr. Sabiha Khan
Guest Faculty , Department of Geography, U.C.S.S.H., M.L.S.University, Udaipur.