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Analysis of Commodity Carrier Vehicles Movement in an Urban Area – A Case Study of Himatnagar

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ABSTRACT: Urban commodity movement essential for prosperity of urban areas. In growing/developing Himatnagar city demand of consumption of the commodity is increasing rapidly. That results in frequent movement of commodity vehicles on urban streets throughout the day. Generally, researchers have focused on private vehicles and mass transits vehicles in urban area. A very few studies have been done to analyze the effect of commodity vehicles in urban area. Therefore, this study is aimed to analyze the commodity carrier movement in developing city like, Himatnagar. Traffic surveys have been carried out to determine model share of goods vehicles in total traffic stream, origin and destination of commodity vehicles according to types of commodity, their effect on traffic flow parameters. This study reveals that the average proportion of goods/commodity vehicles is about 10-13% and the significant parameters to generate these vehicle trips are shopping area and number of customers coming to the shops. It is observed that LCV are mostly used for commodity supply and their timings of trips are between 10 AM to 11 AM. More trips are observed for Grocery, Dairy Products, Hotels and Electronic item shops.

Keywords-Transportation Planning, Trip generation, urban level

I. INTRODUCTION

1.1 General

Transportation plays vital roles in development and growth of any nation. Transportation comprising different mode of transportation like road, railway, waterway and shipping. These modes of transport provide movement of goods and people one place to another place road. Road transport is primary mode of transport which plays important role in conveyance of good and passengers and linking the center of production, consumption and distribution.

Urban goods movement is a vital for the prosperity of any cities, especially the shopping area that fulfil in important role for the city and region. Goods transport also causes noise, air pollution and traffic problems. Goods movement, transportation things rather than people is addressed as a separate element. Trucks move most of the freight in many countries. Light freight delivery uses many modes of transport including truck, air freight and automobile. Goods movement covers all transportation method by which freight, commodities, and information are transported into and out of place of country. The most common methods to transport freight and commodities are rail, truck, airway, waterway, while information can be transported using optic fiber cable, cellular towers, telephone wire, radio waves, electrical wires, and other technologies. There is a wide spectrum of goods movement problem. These range from a broad concern about spatial pattern of goods movement demand created by different land use arrangements to the design of trucks loading facilities in the center of the city. Little attention has been directed towards the problem of goods movement in past transportation planning studies. Urban goods movement as an important part of traffic and transportation planning. Therefore, major factors playing considerable role in urban goods movement be identified and studies.

In India, Freight Transport through National Highway play vital role had given the current inefficient Freight Facilities of Indian Railway. As per the National Highways Authority of India, about 65% of freight traffic is carried by the roads. The National Highways carry about 40% of total road traffic. Average growth of the number of vehicles has been around 10.16% per annum over recent year. It provides end delivery services for every other long-haul mode. It provides end delivery services for every other long-haul mode.

Figure 1: Himatnagar Location

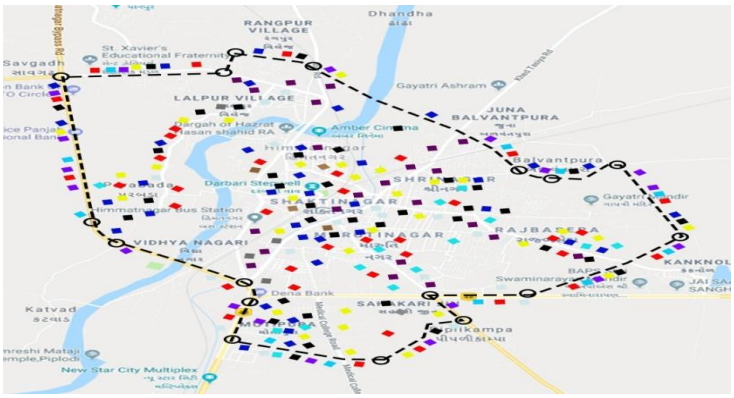


Figure 2: Location of shops

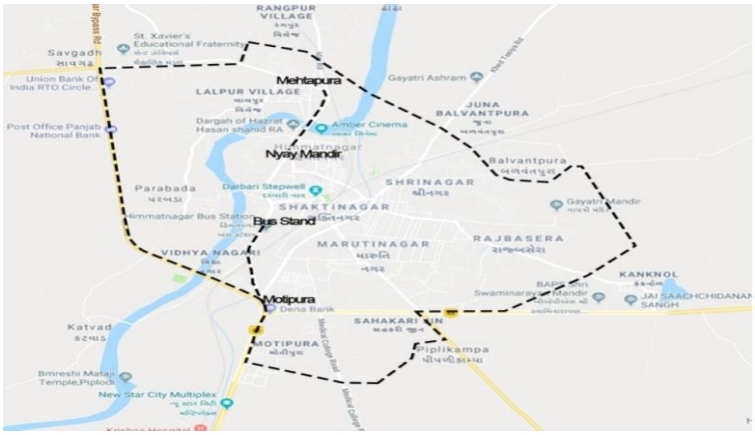


Figure 3: Traffic Volume Count at Different road stretches

II. Review of Literature

Russo et al.(2011) have shown in this research paper urban and metropolitan goods movements is increasing because they account for a substantial share of traffic in urban and metropolitan areas. In this context, many city administrators have implemented measures to mitigate the negative effects of freight transportation. Starting from an analysis of existing studies relative to freight policies implemented at the urban scale in Europe, this paper proposes a general classification of measures adopted at the urban scale and an analysis of expected goals and tested results. Each described measure is analyzed by considering the temporal reference scale (strategic, tactical, and operative) of the actors and decision makers involved. Each measure pursues and is linked to one or more expected goal, and the empirical results obtained in the European cities and demonstrated by specific indicators representing the goal are presented.

Kulpa, T. (2014) has concluded that Freight truck trip generation is a crucial part of a 4-stage model, especially in regional freight model development. Based on results of roadside surveys O-D matrices for freight vehicles were estimated. In the next step, using large set of traffic measurements on national road and regional road; O-D matrices were calibrated. In order to calculate trip generations a step backwards was made. Additionally, the results of comprehensive travel studies and secondary data were used. The aim of this paper is to develop freight truck trip generation equations at regional level using different data sources, secondary data and indirect approaches. Equations of trip generation for light truck and heavy truck shown below:

For Light truck, P=A=0.077·LM + 0.303·LPU
For Heavy truck, P=A=0.102·LPP + 0.406·LPU

Where, LM= Number of inhabitants

LPU= Employment in services

LPP= Employment in industry

In model development different methods were used: trip generation rates, multiple regression and artificial neural networks. Although the easiest to apply are the trip generation rates, it may not reflect commune characteristic.

Dr. Varia & Parikh (2016) have developing Safe, economic and timely transportation of passengers and goods/freight is necessary for the development of any nation. Efficient shopping activities are important for the transportation. Due to increased population and shopping malls and retails/wholesale hub, satisfying the need for the fast supply of consumers' products at regional and urban level becomes essential. Special shopping activities are inevitable to develop for the uninterrupted movement of public at regional level. At urban area level it is interesting to know about the movement of people. In the highly dense populated urban area, trips of shopping may be considerable to affect the passenger vehicle trips. How these trips increase with respect to increase in population? Which commodities generate more trips of supply? What is the influence of shop area on these trips? Which are the other factors significant to generate these trips? These are the questions to be answered in the context of today's rapid urbanization, which may be helpful to develop shopping trip generation model on the urban road network.

III. Methodology

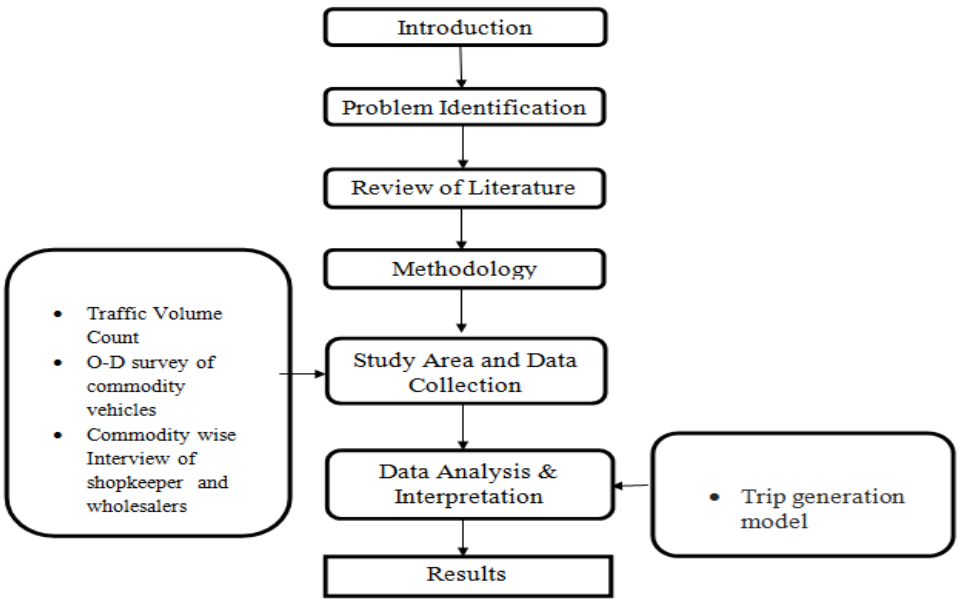
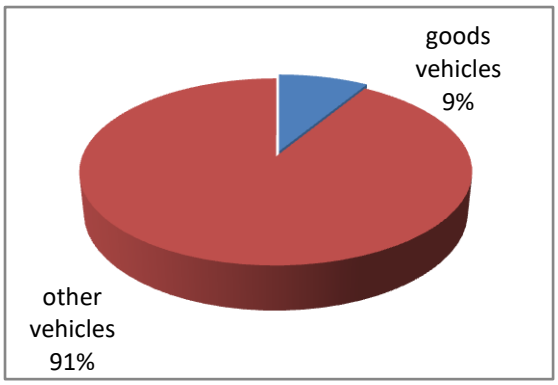


Figure 4 Methodology Chart

Data Collection

Table 1 Traffic volume count at road stretch: Mehta Pura circle to Civil circle

TIME	2W	3W		4W	LCV	Bus	Truck	NM	Total	PCU/Hr.
		Pass	Goods							
6 to 7	435	290	20	425	60	55	0	0	1285	1215
7 t0 8	485	385	45	485	75	60	0	5	1540	1447.5
8 to 9	553	566	61	529	91	75	0	8	1883	1771.4
9 to 10	546	522	66	512	78	80	0	10	1814	1709
12 to 1	596	485	71	452	94	95	0	1	1794	1734.3
1 to 2	592	470	48	443	81	90	0	6	1730	1647.8
4 to 5	775	441	81	531	150	84	0	8	2070	1961.7
5 to 6	753	526	62	515	112	92	0	12	2072	1932.7
6 to 7	700	505	54	490	105	82	0	7	1943	1806.6
Total	5435	4190	508	4382	846	713	0	57		



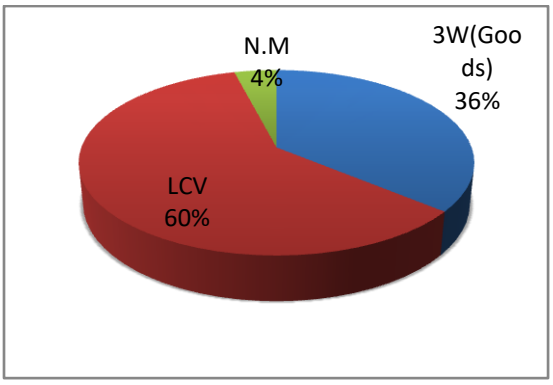
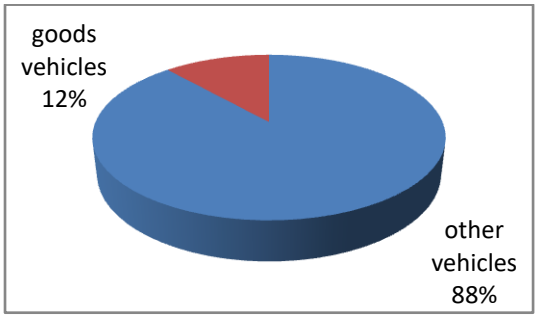


Figure 5 Percentage of goods carrier vehicles atFigure 6 Goods carrier vehicle volume count for Road stretch A: Mehta Pura circle to civil circleroad stretch A: Mehtapura circle to Civil Circle

Table 2 Traffic volume count at road stretch B: Motipura circle to Civil circle

Time	2W	3W		4W	LCV	Bus	Truck	NM	TIPPER/ DIPPER	TOTAL	PCU/HR
		Pass	Goods								
6 TO 7	475	285	48	485	79	68	46	2	4	1492	1576.1
7 TO 8	495	300	54	515	96	75	58	5	16	1614	1779.4
8 to 9	512	332	69	561	101	73	55	2	28	1733	1906.4
9 to 10	995	712	153	814	132	93	49	10	7	2965	2817.4
12 to 1	722	400	121	553	119	79	57	1	11	2063	2107.3
1 to 2	650	366	102	515	117	81	51	5	14	1901	1983.8
4 to 5	726	539	65	610	99	115	20	2	5	2181	2164.4
5 to 6	827	609	63	700	93	113	22	7	3	2437	2340.1
6 TO 7	780	578	60	684	82	102	24	6	8	2324	2235
TOTAL	6182	4121	735	5437	918	799	382	40	96		



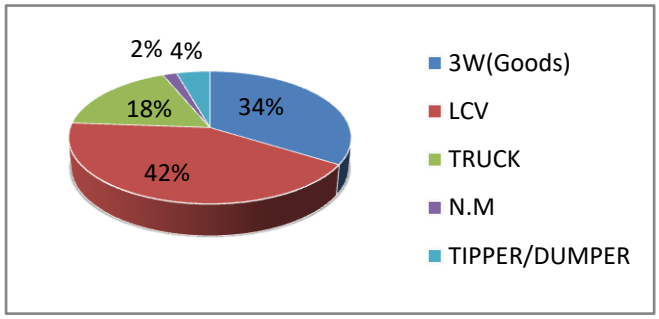


Figure 7 percentage of goods carrier vehicle at Figure 8 Goods carrier vehicle volume count at Road stretch B: Motipura circle to Civil circleroad stretch B: Motipura circle to Civil circle

Table 3 Data collected from interview of shopkeeper

Types of commodity	No of shop visited	Types of vehicle used	No of trips/day	Total No of customers/ day	Total Area of shop(sq. meter)
Bakery shop	17	LCV	43	1280	206
Grocery shop	22	LCV	50	2270	346
Dairy product shop	17	LCV/2w	27	2120	309
Electronics shop	22	LCV/2w	42	590	435
Food shop	20	LCV/2w	38	1317	443
Florist shop	7	LCV/2w	12	153	31
Toy store	16	LCV	32	898	167
Pharmacy shop	17	LCV	33	1460	185
Sports shop	2	LCV	3	54	22
Stationary shop	18	LCV	30	1462	365
Home appliances	4	LCV	7	238	83
Furniture	16	LCV	36	375	735
Hard ware shop	13	LCV/Truck	22	385	235
opticians shop	13	2w	21	318	134
Plywood shop	4	LCV	10	135	530
Foot ware shop	16	LCV/2w	34	2025	325
Gift/decoration shop	3	LCV	3	105	56
Cloth shop	21	LCV/Truck	28	2070	395
Building material	12	LCV/Truck	28	251	195

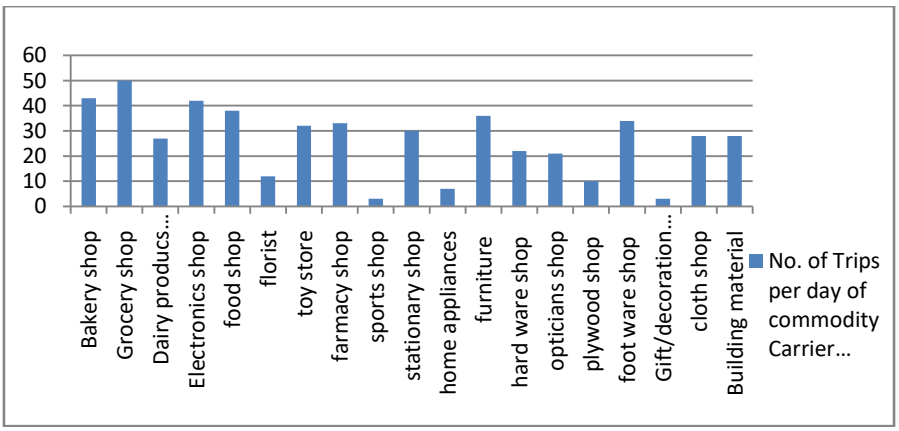


Figure 9 Trips per day of commodity carrier vehicles

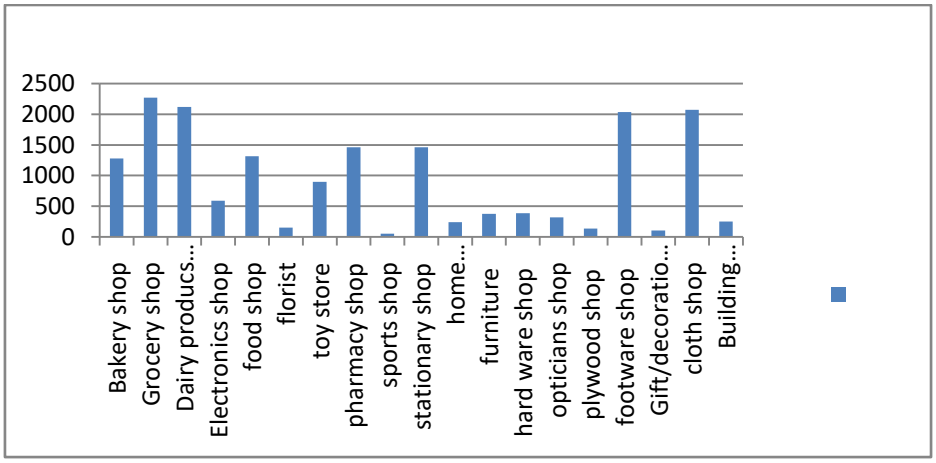


Figure 10 Total no. of customer per day

In figure 9 shows that total number of trips rates per day of commodity carrier vehicle presented. Its shows that grocery items carrier vehicle trips rate is higher than the other types of commodity and lowest trip rate of gift shops and sport shops.
In figure 10 show that number of customer is higher at grocery shops and lowest customer at sport shops.

Table 4 Data collected from O-D survey of goods vehicles

Frequency of goods delivery vehicle	Types of commodity	Avg. travel distance from wholesaler(km)	Avg. travel time from wholesaler to shop(min)	Types of vehicles used	Timeslot of delivery
Daily	Bakery item	2	12	LCV	10-11 AM
	Grocery	2	10	LCV	9-10 AM
	Dairy products	4	20	LCV/2-wheeler	7-8 AM
	Electronics	3	15	LCV/2-wheeler	5-6 PM
	Food shop	2	14	LCV/2-wheeler	9-10 AM
	Florist	1	8	LCV/2-wheeler	8-9 AM
Weekly	Toy store	2	12	LCV	9-10 AM
	Pharmacy shop	2	13	LCV	10-11 AM
	Sport item	1.5	12	LCV	10-11 AM
	Stationary item	1.5	12	LCV	10-11 AM
	Plastic wares and home appliances	2	13	LCV	10-11 AM
	Furniture	2	13	LCV/Truck	5-6 PM
	Hardware item	2	14	LCV/Truck	10-11 AM
	Opticians	2	12	2-Wheeler	5-6 PM
	Plywood	3	18	LCV	9-10 AM
	Footwear	2	12	LCV	10-11 AM
	Gift/Decoration shop	3	18	LCV/2-wheeler	9-10 AM
	Cloth shop	2	10	LCV/Truck	10-11 AM

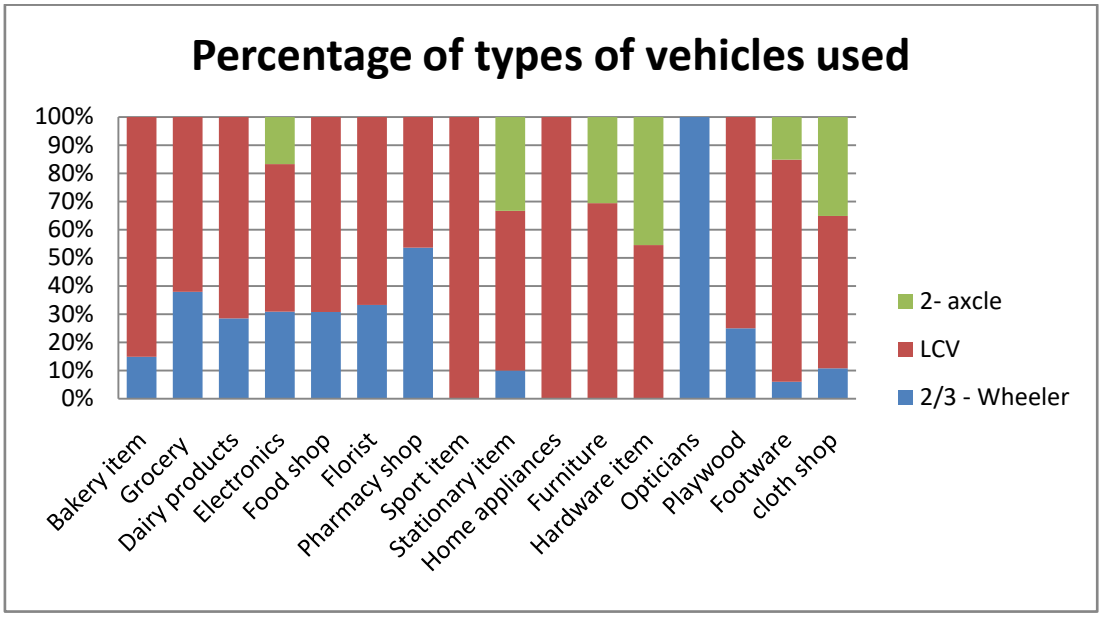


Figure 11 Percentage of types of vehicles

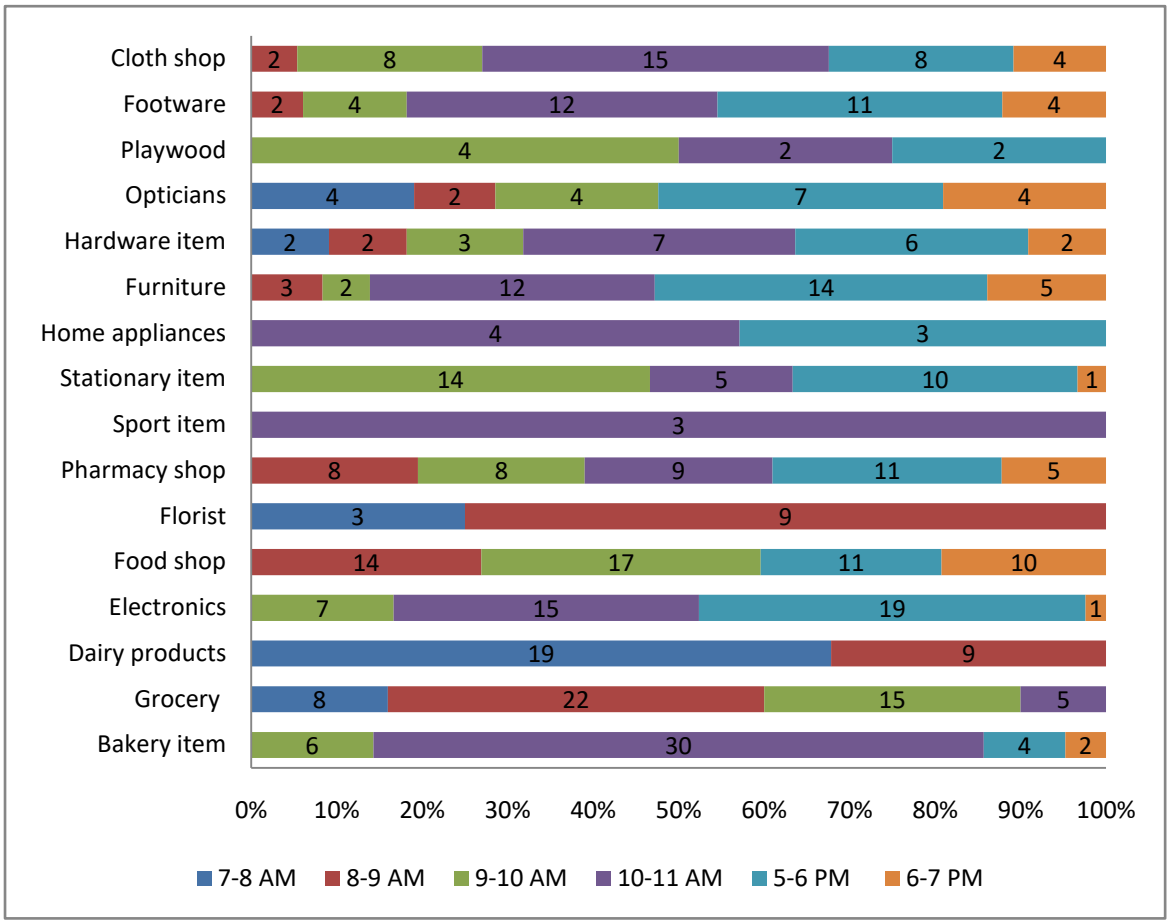


Figure 12 Time wise commodity flow

In figure11 represent amount of commodity carrier vehicles like 2/3-wheeler, LCV and 2-axle. LCV having higher percentage of compared to 2/3 wheeler and 2-axcle. 2- Wheelers are used for opticians and florist shops. 2-axles are mostly used for furniture shops, hardware shops, electronics shops and cloths shops.

In figure 12 represent time wise commodity flows. In this fig. also show percentage of volume of goods vehicles flow. Higher percentage of commodity flow of vehicles in 9-10 AM, 10-11 AM and 5-6 PM.

MODAL DEVELOPMENT

5.4.1 Commodity carrier vehicles trip generation model for dairy products shops.

Y= 0.069AS + 0.016C - 0.401TD + 0.142 ……. (I)

Where,

Y= No. of trips per day

TD= Travel distance from wholesale to retailer (km)

AS= Area of shop (sq. meter)

C= Number of customers arrived in shops per day (approx.)

5.4.2 Commodity carrier vehicles trip generation model for Electronics shops:

Y=0.120AS – 0.075TD – 0.037TT + 0.347 ……. (II)

Where,

Y= No. of trips per day

TD= Travel distance from wholesale to retailer (km)

AS= Area of shop (sq. meter)

TT= Travel time required for travel from wholesaler to retailers (min)

5.4.3 Commodity carrier vehicles trip generation model for Bakery shops:

Y=0.162AS – 0.709TD + 2.197 ……. (III)

Where,

Y= No. of trips per day

TD= Travel distance from wholesale to retailer (km)

AS= Area of shop (sq. meter)

5.4.4 Commodity carrier vehicles trip generation model for cloths shops:

Y=0.024C – 0.114TT + 0.312 ……. (IV)

Where,

Y= No. of trips per week

TT= Travel time from wholesale to retailer (min)

C=customer (approx.)

VI. CONCLUSION

1. This study reveals that the average proportion of commodity vehicles is 10-13 %
2. The significant parameters to generate these vehicle trips are travel time, travel distance,area of shops, no. of customers.
3. In this study observed that LCV are mostly used to commodity supply and their timing of trips is between 10 AM to 11 AM.
4. In this study Trip Generation Model Develop for various types of commodity vehicles like Bakery Shops , Cloth shops , Electronic shops , Dairy Shops

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