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A LAND USE TRANSPORTATION MODEL FOR ANALYSING TRANSPORTATION IMPACT IN AVKUDA REGION

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Abstract — *Transportation engineering is application of scientific principles to planning, designing, operation and management of transportation system. The relation between transportation and land use are at heart of urban growth. Transport planning decisions affect land use development, and land use conditions affect transport activity. The AVKUDA region has been experiencing significant land-use changes due to increasing growth and sprawl. Along with more traffic, new development has spread farther from central city, causing increased demand for transportation services in developing areas and placing strain. In present study, the household survey is carried out for data collection and different land use area are categorized and calculated such as residential area, agricultural area, commercial Area, industrial area and public purpose area and the map is digitized in Trans CAD software. The total trips are calculated and O-D matrix is generated. The regression analysis carried out and results shows that the total trips of agricultural area is reduced and in other categorized land use area, trips are increased.*

Key words: Land use transportation model, AVKUDA

I. INTRODUCTION

Transportation engineering is application of scientific principles to planning, designing, operation and management of transportation system. The relation between transportation and land use are at heart of urban growth. As increases in changing in land use pattern, the requirements for estimating and forecasting travel demand becomes more important. The AVKUDA region has been experiencing significant land-use changes due to increasing growth and sprawl. Along with more traffic, new development has spread farther from central city, causing increased demand for transportation services in developing areas and placing strain. The planning agencies need to develop strategies that will mitigate the effect of growth. Anand city has witnessed a well-planned network through the town at early stage of development. The city is farther developing towards Vallabh-vidyanagar. There is a constant increase in population, income, number of vehicles, numbers of trips, household leads to impact on land use. In this study the transportation impact is carried out by land use.

LITERATURE REVIEW

There is a few research are available for Land Use transportation models. Sabyasachee Mishra, Xin Ye, Fred Ducca, & Gerrit-Jan Knaap gives the step wise procedure for land use transportation model and gives the results for increasing traffic volume based on business as usual and high gasoline price criteria.^[1] Siva Karthik Kakaraparthi, Kara M. Kockelman (2011) gives the information about the modeling of year-2030 land-use pattern of the Austin, Texas Region using UrbanSim.^[2] Michael J. Clay (2010) gives the detail information about the integrated land use transportation model PECAS. And it is used to implement an integrated model development project in the Montgomery.^[3] John Davis, Jojo Valero, David Young (2009) begins with an overview of the integrated system of new regional transport demand and land-use models developed for Auckland Regional Council and the model application resolved around the testing of growth scenario to 2051.^[4] Adrienne Brandi, Stefano Gori, Marialisa Nigro, Marco Petrelli (July 2014) proposed a model consists in a sequence of steps designed to modify the current urban land use structure and the current mobility habits through a relocation of existing activity volumes close to the existing mass transit links of the city with available residual capacity.^[5] Jeninifer Duthie, Kara Kockelman, Varun Valsaraj, Bin Zhou (November 2007) gives the two land use models, TELUM and UrbanSim were compared based on data requirements and presentation of results.^[6] Paul Waddell, Terry Moore, Sharon Edwards (May 1998) gives the detail information about describes the use of parcel-level data in the development of UrbanSim, the Oregon Prototype Metropolitan Land Use Model, and its application to the Eugene-Springfield Metropolitan Area.^[7]

II. AIM & OBJECTIVES OF THE STUDY

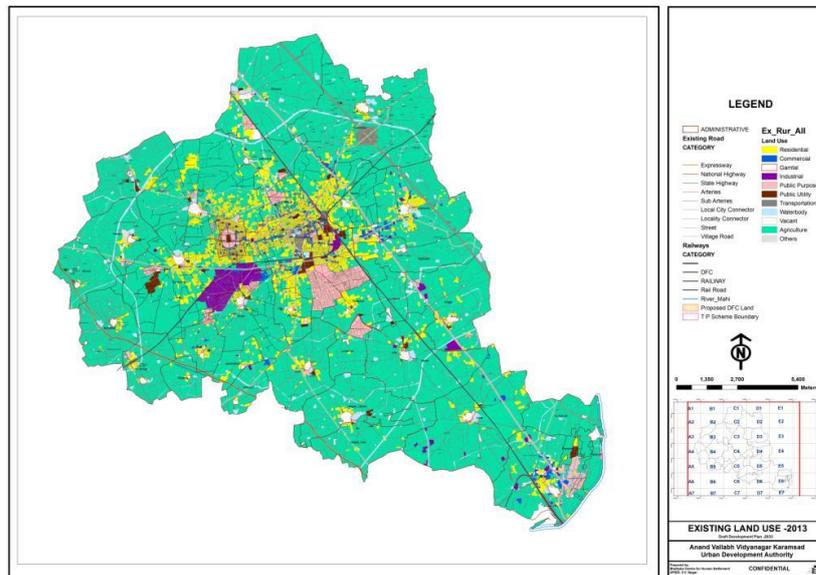
Aim of research is to generate trip generation model using land use.

Objectives of study is to generate the model of trip generation using the land use for the AVKUDA (Anand Vidhyanagar Karamsad Urban Development).

III. STUDY AREA PROFILE

The constituted AVKUDA area is covering thirty villages of Anand Taluka in addition to the Anand, Karamsad, Vallabh Vidyanagar, Boriyavi Nagarpalika and Vitthal Udyognagar, a notified area. The total villages are as following: Adas, Anand, Mogri, Bakrol, Ankalvadi, Boriya, Boriyavi, Chikhodra, Gamdi, Gana, Gopalpura, Hadgood, Jakhariya, Jitodiya, Jol, Karamsad, Khandhli, Lambhvel, Meghawa, Mogar, Morad, Napad-talpad, Napad-vato, Navli, Rajupura, Samrakha, Sandesar, Vadod, Vaghasi, Valasan, Vallabh Vidhyanagar, Vanskhiliya and Vasad. In AVKUDA area, Vallabh Vidyanagar has highest family size of 5.81 and Khandhli has small family size of 4.61 persons. Average family size in the urban area is of 5.16 whereas in rural area it is 5.07 persons. Figure 4.1 shows the land use map of AVKUDA region.

Fig. 4.1 Land use map of AVKUDA region



IV. DATA COLLECTION

In present study, the household study is carried out. The data required for this study are as follows: Household information: The household information includes information such as name of household, address, size of households, age and sex structure of household, house ownership, built-up area, no of vehicles and their types, occupation and income of the household, place of work, vehicle ownership and so on. Travel data: The travel data includes information on all journeys made during the previous 24 hours of period, including origin and destination of trip, purpose of the trip, mode of travel, distance of the trip, and average expense on travel and fuel type and so on.

V. DATA ANALYSIS

Built up area of households

The built up area of households are categorizes in main four types as less than 250 sq. ft. which covers about 1% of total households , 250- 500 sq. ft. which covers the 11% of the total households , 751-1000 sq. ft. which covers about 45% of total households and greater than 1000 sq. ft. which covers about 43% of the total households.

Vehicle ownership

The proportion of vehicle ownership is observed in AVKUDA region. The two wheeler share is 70% which is highest, followed by four wheeler which is 14%, for cycles it is 12%, 3% for auto rickshaws and 1 % for Tractors.

Land use categories

By using the digital planimeter, the land use data are carried out. The land use data are categories as residential, commercial, agricultural, industrial and public purpose. The same is described below with area. Residential land use: In this category land having residential societies, low rise and high rise apartments are considered. The total Residential area of AVKUDA is about 7219.65 hectares. Commercial land use: This land use contains buildings which are having zero residential use. Hospitals, malls, commercial complexes are falling under this category. The total area of commercial land use in AVKUDA is about 312.54 hectares. Agricultural land use: This land use contains the agricultural land. It includes farms. The total agricultural are in AVKUDA is about 17017.39 hectares. Public purpose land use: It includes the banks, bus stands, etc. in this category. The total public purpose land area in AVKUDA is about 747.88 hectares. Industrial land use: It contains the different industries which are free from residents are categorized in it. The total industrial land use area in AVKUDA is about 599.16 hectares. After the categorized land use calculation, the total trip of AVKUDA is calculated.

S R · N O	NAME OF VILLAGE	RESIDE NTIAL AREA (Ha)	AGRICUL TURAL AREA (Ha)	INDUS TRIAL AREA (Ha)	COMME RCIAL AREA (Ha)	PUBLI C PURP OSE AREA (Ha)	TOTAL AREA (Ha)	TR IP S	TRIP RATE (Person s/HH)	NO OF HH	TOT AL TRIP S
1	BORIYAV I	466.00	819.50	0.00	12.00	31.50	1502.0 0	41	0.82	355 9	2918 .38
2	SAMARK HA	154.00	1920.80	104.00	0.00	23.00	2278.0 0	66	1.32	391 1	5162 .52
3	LAMBHV EL	123.00	736.00	0.00	13.00	0.00	902.00	63	1.26	829	1044 .54
4	BAKROL	307.60	775.60	0.00	0.00	193.08	1658.0 0	80	1.60	447 9	7166 .40
5	JOL	123.10	596.60	0.00	10.00	0.00	720.28	46	0.92	109 1	1003 .72
6	VALASA N	231.80	336.20	0.00	0.00	40.20	638.75	72	1.44	141 9	2043 .36
7	V.V.NAG AR	124.40	20.00	0.00	24.00	69.36	238.00	12 3	2.46	503 4	1238 3.64
8	GAMDI	319.20	257.76	0.00	20.96	0.00	584.80	59	1.18	253 3	2988 .94
9	KARAMS AD	354.00	425.40	207.00	58.32	39.00	1412.4 0	11 1	1.80	617 9	1112 2.20
10	CHIKHO DARA	312.80	750.00	0.00	40.00	0.00	1130.0 0	78	1.56	257 1	4010 .76
11	ANAND	393.00	30.38	60.66	32.86	139.76	2039.8 0	17 7	2.24	304 96	6831 1.04
12	MORAD	119.60	398.20	0.00	0.00	0.00	519.56	34	0.68	792	538. 56
13	SANDES AR	108.50	597.00	0.00	0.00	0.00	726.00	38	0.76	101 5	771. 40
14	BORIYA	137.50	350.20	12.00	0.00	3.91	511.60	70	1.40	758	1061 .20
15	MEGHW A	138.40	98.00	0.00	0.00	0.00	256.00	78	1.56	331	516. 36
16	GANA	271.50	94.40	0.00	0.00	0.00	365.40	33	0.66	764	504. 24
17	MOGRI	570.40	122.40	102.80	0.00	17.60	837.40	64	1.28	179 7	2300 .16
18	JITODIYA	389.40	15.00	0.00	0.00	18.00	397.97	77	1.54	834	1284 .36
19	VAGHASI	119.40	336.10	0.00	22.00	0.00	583.80	43	0.86	872	749. 92
20	HADGOO D	281.38	206.50	0.00	0.00	13.69	503.46	48	0.96	163 0	1564 .80
21	GOPALP URA	98.40	156.20	0.00	0.00	0.00	242.00	24	0.48	486	233. 28
22	MOGAR	133.25	891.75	63.50	0.00	11.50	1100.0 0	67	1.34	150 5	2016 .70
23	JAKHARI YA	68.60	305.04	0.00	0.00	61.92	359.00	63	1.26	310	390. 60
24	VANSKHI LIYA	123.76	107.20	0.00	0.00	0.00	250.00	43	0.86	520	447. 20
25	KHANDH	148.50	241.50	0.00	28.00	0.00	302.60	67	1.34	361	483.

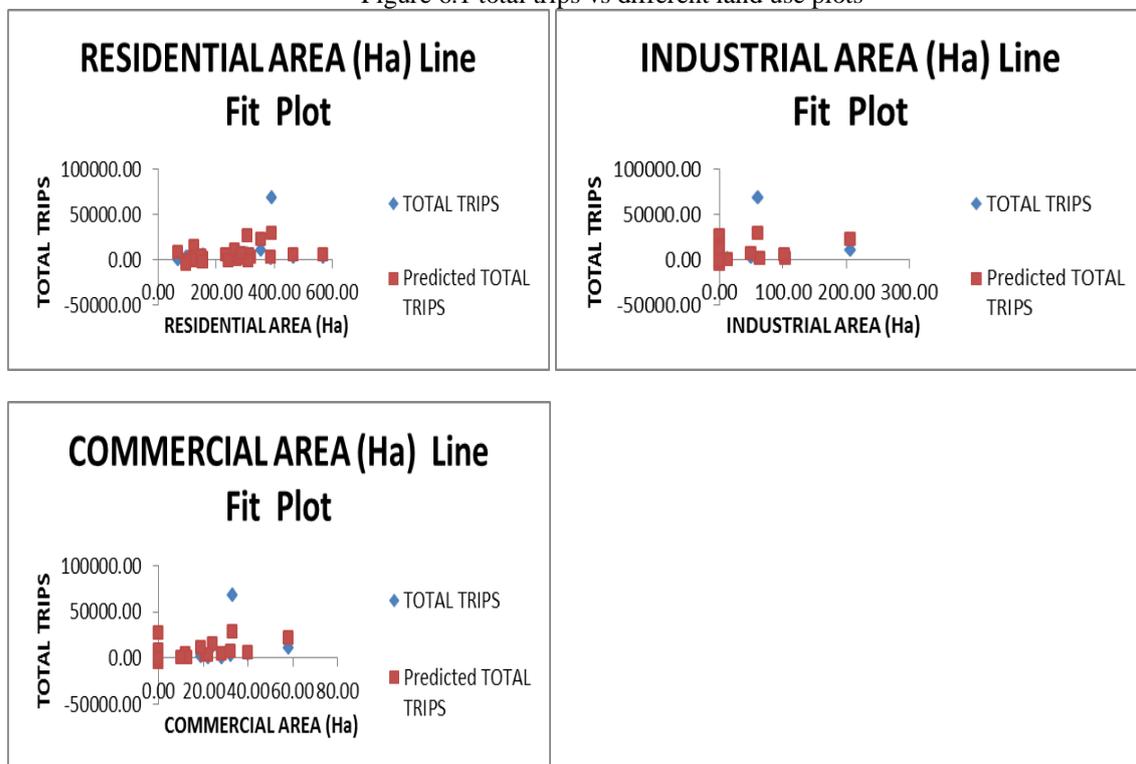
5	LI										74
2	VADOD	99.00	1330.00	0.00	0.00	17.00	1225.00	69	1.38	2007	2769.66
2	ADAS	95.50	1637.50	0.00	0.00	0.00	1635.00	63	1.26	2084	2625.84
2	NAPAD TALPAD	154.00	752.00	0.00	0.00	0.00	836.00	59	1.18	1053	1242.54
2	NAVLI	262.46	464.86	0.00	19.00	56.36	738.00	83	1.66	1386	2300.76
3	NAPAD VANTO	152.20	728.00	0.00	0.00	0.00	887.00	51	1.02	2119	2161.38
3	ANKALVADI	311.10	485.60	0.00	0.00	0.00	606.00	68	1.36	476	647.36
3	VASAD	285.50	785.30	49.20	32.40	12.00	1230.00	69	1.38	2514	3469.32
3	RAJUPURA	242.40	246.40	0.00	0.00	0.00	458.00	61	1.22	700	854.00

A linear regression analysis is carried out for above study. the independent variable of different categorized land use such as residential area, commercial area, industrial area, agricultural area and public purpose area and the dependent variable is total trips.

$$Y = 0.686 * A_1 - 2.815 * A_2 + 29.561 * A_3 + 193.954 * A_4 + 147.430 * A_5 + 43.741$$

Where, Y = Total trips, A₁ = Residential area, A₂ = Agricultural area, A₃ = Industrial area, A₄ = Commercial area and A₅ = Public purpose area.

Figure 6.1 total trips vs different land use plots



VI. CONCLUSION

Conclusion

- The total residential area of AVKUDA is 7219.65 Ha. , agricultural area is 17017.39 Ha. , industrial area is 599.16 Ha. , commercial area is 312.54 Ha and public purpose area is 747.88 Ha.
- The household are categorized in three main types in which the 11% of total households contains 250-500sq.ft. per household, 45% contains 751-1000 sq. ft. per Household, 1% contains less than 250 sq. ft. per household and 43% contains greater than 1000 sq. ft. per households.
- The study area contains 70% of two wheelers, 14% of four wheelers, 12% of cycles, 3% of auto rickshaws and 1% of tractors.

- Total trips of AVKUDA region is 147088.88 per day.
- The average trip length of AVKUDA is 7.84 km
- The regression analysis shown that the trips of residential area, commercial area, industrial area, public purpose area is increasing and the trips of agricultural area is decreasing in AVKUDA region.

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