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Urban Mass Transportation Facility for Smart City: A Case Study of Dahod City

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Abstract— *Transportation system accessing jobs, education, recreation and similar activities is becoming increasingly time-consuming. Billions of man hours are lost with people "stuck in traffic". The primary reason for this has been the explosive growth in the number of motor vehicles, coupled with limitations on the amount of road space that can be provided. Transport crisis adversely affects human lives. Statistics indicate that traffic accidents are a primary cause of accidental deaths in the Indian cities. Further, the changes in urban form and structure in terms of land use, density of population and concentration of activities have changed the travel pattern. In other words, the traffic problems are increasing in the cities in general and the situation is becoming complex especially in core areas of the city. Bus transport is the most desirable and sustainable system from societal perspective. A well planned bus system can provide a high level of mobility to a large section of the population with least cost. However, a poorly planned system causes inconvenience to the users, loses ridership, encourages use of private vehicles and imposes financial burden on the operator.*

Key words*; mass transit service, feasibility of public transportation system, urban transportation city bus service.*

I. INTRODUCTION

Indian cities, of all sizes, face a crisis of urban transport. Despite investments in road infrastructure, and plans for land use and transport development, all cities faces the ever increasing problems of congestion, traffic accidents, air, and noise pollution. Large cities are facing a rapid growth of personal vehicles (two wheelers and cars) and in medium and small cities different forms of intermediate public transport provided by the informal sector are struggling to meet the mobility demands of city residents**.** Transportation demands in urban areas continue to increase rapidly as a result of both population growth and changes in travel patterns. In the era of environment concerns and limited space available in cities, transport planners have to provide a system, which can ensure safe and clean mobility to all city residents. This requires planning a system, which is affordable, reliable and efficient from the users' as well as operator's perspectives.

II. PROBLEM STATEMENT

Traffic congestion has been increasing in Dahod city due to use of more private vehicles on road as shown in fig 1.4. Due to lack of public transport facility people switch to private vehicles such as rickshaw, chakdas, two wheelers and car, being selected in smart city mission as per norms the city should have a B.R.T.S kind of public transport but looking at the present situation it seems impossible in city where not even a city bus system is planned.

As education facility has been increasing in Dahod city every private school has its own private buses and van for pickup facility of their students, moreover students of colleges and government servants working in Government College, Seva sadan, Panchayat and district court usually travel by rickshaw, chakdas or their own private vehicles which also increase traffic problems in peak hours in Dahod city.

The pollution level of Dahod city is on curse due to more use of private vehicle so to reduce pollution and sustainable development, city bus is required The population of Dahod city is increasing rapidly, as population is growing requirement of city bus service is necessary.

III. AIM OF THE STUDY

The main aim of the study is to plan mass urban transport facility for development of Dahod city which includes; a well planned city bus system can provide a high level of mobility to a large section of the population with least cost.

IV. OBJECTIVE OF STUDY

- To check the feasibility for providing a city bus service.
- To identify the potential routes for city bus service.

V. METHODOLOGY

The methodology of work is part of that planning phase. It covers the whole work which is going to be carried out for the completion of thesis. The first step in methodology is to identify the problem; it covers the subject of work. The next is literature review, in this step the previous year's works on that subject are collected and has been studied carefully. The third step is to select study area for implementing thought of work and it should be suitable for objective. After the selection of study area the objective of work should be decided. For achieving that goal, the data collection and data analysis results some remedial measure for road safety is going to be suggested. Last step is to give conclusion of this whole work done.

5.1 Home Interview Survey

A random sample of 3.5% percent of the population it selected and the residence are visited by me who collect the travel data from each member of the house hold. The data may be collected useful either for planning the road network and other roadway facilities for the vehicular traffic for planning the mass transportation requirements of the passengers. The problem of stopping vehicles and consequent difficulties are avoided altogether. The present travel needs are clearly known and the analysis is also simple. Additional data including socio economic and other details may be collected so as be useful for forecasting traffic and transportation growth. But to have complete coverage of the entire cross section of the population is very tedious. While planning for O and D studies at a place it is necessary to decide the method of study.

5.2 Roadside Interviews Study

The vehicles are stopped at previously decided interview station by a group of persons and the answer to prescribe questionnaire are collected on the stop the information collected include the place and time of origin and destination, route, location of stoppages the purpose of the trip type of vehicle and number of passengers in each vehicle.

In this method the data is collected quickly in short duration and the field organization is sample and the team can be trained quickly. The main drawback of the method is that the vehicular movement. Also resentment is likely from road users. Further, unless is enough space, undue congestion may result due to stopped vehicles.

VI. DATA ANALYSIS

After data collection from home interview survey, Origin Destination matrix will be generated from that Travel demand can be identified for different zones. Desire line diagram will have obtained from O-D matrix. Desire diagram will be generated using Trans-cad software.

VII. STUDY AREA

The study area taken for the research work is Dahod city. Dahod, on the banks of river Dudhimati, is a small city in Dahod District in the State of Gujarat, India. The city serves as District Headquarters for Dahod District. It is approximately 200 km away from Ahmedabad and 150 km away from Vadodara. It is also known as Dohad (meaning "two boundaries", as the borders of the states of Rajasthan and Madhya Pradesh are nearby).

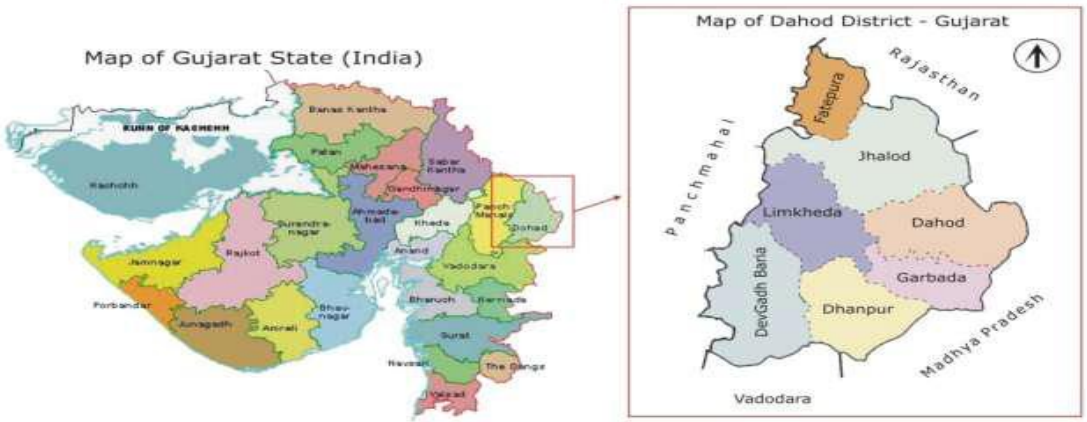


Figure 1. Location of Dahod in the Gujarat

Table 1. Connectivity of different cities from Dahod

Connectivity	Road (km)	Rail (km)	Air
Gandhinagar	222	271	Nearest Airport is Vadodara
Ahmedabad	204	248	
Vadodara	150	148	
Surat	300	277	
Indore	201	289	
Anand	153	182	

Table 2. Population of Dahod city

Year	Male	Female	Other	Total
1991	34250	32250	-	66500
2001	40724	38414	-	79139
2011	48102	46240	4	94350

VIII. Trip generation from Category Analysis

1. Trip generation model for Zone 1

Correlations Original Variables					
	H.H size	Workers	vehicle	Income	Students
H.Hsize	1.000	-.125	-.120	.281	.286
Workers	-.125	1.000	-.121	.036	.101
vehicle	-.120	-.121	1.000	-.157	-.154
Income	.281	.036	-.157	1.000	.131
Students	.286	.101	-.154	.131	1.000
Dimension	1	2	3	4	5
Eigenvalue	1.580	1.129	.876	.819	.596
Correlations Transformed Variables					
	H.H size	Workers	vehicle	Incm	Students
H.H size	1.000	-.092	.008	.249	.192
Workers	-.092	1.000	-.158	-.001	.049
Vehicle	.008	-.158	1.000	-.039	-.057
Income	.249	-.001	-.039	1.000	.089
Students	.192	.049	-.057	.089	1.000
Dimension	1	2	3	4	5
Eigenvalue	1.368	1.186	.909	.838	.699

The above table of correlation original variable shows that there is no linear correlation among the independent variables ranging between -0.125 and 0.286 indicating the absence of multi colinearity among the chosen variable.

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.593	.352	.281	.648
Dependent Variable: trips; Predictors: H.H.size Workers vehicle income Students			

2. Trip generation model for zone 2

Correlations Original Variables					
	H.H size	income	worker	student	Vehicle
H.H size	1.000	-.032	.587	.350	.592
incm	-.032	1.000	-.037	-.113	-.083
worker	.587	-.037	1.000	-.136	.205
student	.350	-.113	-.136	1.000	.249
vehicle	.592	-.083	.205	.249	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.045	1.179	.963	.623	.190

Correlations Transformed Variables					
	H.H size	income	worker	student	Vehicle
H.H size	1.000	.002	.477	.333	.504
Income	.002	1.000	-.044	-.004	-.149
Worker	.477	-.044	1.000	-.145	.196
Student	.333	-.004	-.145	1.000	.237
Vehicle	.504	-.149	.196	.237	1.000
Dimension	1	2	3	4	5
Eigenvalue	1.902	1.154	1.021	.615	.309

The above table of correlation original variable shows that there is no linear correlation among the independent variables ranging between -0.032 and 0.592 indicating the absence of multi colinearity among the chosen variable.

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.439	.192	.025	.808
Dependent Variable: trip; Predictors: hhsize incm worker student vehicle			

3. Trip generation model for zone 3

Correlations Original Variables					
	H.H size	Income	Workers	Students	Vehicle
H.H size	1.000	.142	.631	.689	.145
Income	.142	1.000	.210	.250	.100
workers	.631	.210	1.000	.285	.182
students	.689	.250	.285	1.000	.233
vehicle	.145	.100	.182	.233	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.272	.940	.900	.713	.175

Correlations Transformed Variables					
	H.H size	income	Workers	Students	Vehicle
H.H size	1.000	.066	.982	.643	.043
Income	.066	1.000	.051	.091	.039
Workers	.982	.051	1.000	.594	.003
Students	.643	.091	.594	1.000	.369
Vehicle	.043	.039	.003	.369	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.535	1.123	.982	.344	.016

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.838	.703	.662	.297
Dependent Variable: trips; Predictors: hhsize incm workers students vehicle			

The above table of correlation original variable shows that there is a linear correlation among the independent variables ranging between 0.100 and 0.689 indicating that there exist a relation of multi colinearity among the chosen variable.

4. Trip generation for zone 4

Correlations Original Variables					
	H.H size	Income	student	workers	Vehicle
H.H size	1.000	.422	.624	.588	-.125
Income	.422	1.000	.380	.122	.096
Student	.624	.380	1.000	.231	.152
Workers	.588	.122	.231	1.000	-.042
Vehicle	-.125	.096	.152	-.042	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.230	1.137	.827	.600	.206

Correlations Transformed Variables					
	H.H size	Income	student	workers	Vehicle
H,H size	1.000	.411	.830	.291	-.047
Income	.411	1.000	.344	.123	.158
Student	.830	.344	1.000	.047	.029

Workers	.291	.123	.047	1.000	-.074
Vehicle	-.047	.158	.029	-.074	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.157	1.114	.932	.668	.129

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.566	.320	.242	.680
Dependent Variable: trips; Predictors: hhsize income student workers vehicle			

The above table of correlation original variable shows that there is no linear correlation among the independent variables ranging between -0.042 and 0.588 indicating the absence of multi colinearity among the chosen variable.

5. Trip generation of zone 5

Correlations Original Variables					
	income	H.H size	vehicle	Students	Trips
Incm	1.000	.192	.054	.123	.231
H.H size	.192	1.000	.222	.615	.611
Vehicle	.054	.222	1.000	.314	.100
students	.123	.615	.314	1.000	.222
zone 5	.231	.611	.100	.222	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.191	1.043	.863	.667	.235
Correlations Transformed Variables					
	income	H.H size	vehicle	Students	Trips
income	1.000	.098	.021	.083	.163
H.Hsize	.098	1.000	-.054	.609	.955
vehicle	.021	-.054	1.000	.235	-.051
students	.083	.609	.235	1.000	.593
zone 5	.163	.955	-.051	.593	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.482	1.095	.976	.404	.042

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.510	.261	.070	.739
Dependent Variable: trips; Predictors: incm hhsize vehicle students zone 5			

The above table of correlation original variable shows that there is no linear correlation among the independent variables ranging between 0.054 and 0.615 indicating the absence of multi colinearity among the chosen variable.

6. Trip generation for zone 6

Correlations Original Variables					
	H.H size	Income	workers	Students	Vehicle
H.H size	1.000	.264	.656	.558	.087
Income	.264	1.000	.266	.060	.077
Workers	.656	.266	1.000	.141	.174
students	.558	.060	.141	1.000	-.214
Vehicle	.087	.077	.174	-.214	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.061	1.253	.857	.630	.199

Correlations Transformed Variables					
	H.H size	Income	workers	Students	Vehicle
H,H size	1.000	.168	.619	.472	-.090
Income	.168	1.000	.273	.077	.069
Workers	.619	.273	1.000	.122	-.093
students	.472	.077	.122	1.000	-.074
Vehicle	-.090	.069	-.093	-.074	1.000
Dimension	1	2	3	4	5
Eigenvalue	1.956	1.084	.925	.764	.271

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.665	.442	.336	.558
Dependent Variable: trips; Predictors: hhsize incm worker's students vehicle			

The above table of correlation original variable shows that there is no linear correlation among the independent variables ranging between -0.214 and 0.656 indicating the absence of multi colinearity among the chosen variable.

7. Trip generation for zone 7

Correlations Original Variables					
	H.H size	Income	workers	Students	Vehicle
H.H size	1.000	.053	.513	.626	.051
Income	.053	1.000	.147	.087	.019
Workers	.513	.147	1.000	.278	.127
students	.626	.087	.278	1.000	.049
Vehicle	.051	.019	.127	.049	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.000	1.010	.981	.703	.306

Correlations Transformed Variables					
	hhsize	Incm	workers	Students	Vehicle
hhsize	1.000	.474	.700	.476	.605
incm	.474	1.000	.734	.111	.694
workers	.700	.734	1.000	.209	.896
students	.476	.111	.209	1.000	.127
vehicle	.605	.694	.896	.127	1.000
Dimension	1	2	3	4	5
Eigenvalue	3.163	1.077	.402	.268	.090

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.802	.643	.600	.357
Dependent Variable: trips; Predictors: hhsize incm workers students vehicle			

The above table of correlation original variable shows that there is a linear correlation among the independent variables ranging between 0.019 and 0.626 indicating that there exist a relation of multi colinearity among the chosen variable.

8. Trip generation for zone 8

Correlations Original Variables					
	H.H size	worker	incm	Student	Vehicle
H.H size	1.000	.668	.414	.554	.073
Worker	.668	1.000	.208	.224	.049
Income	.414	.208	1.000	.365	-.129
Student	.554	.224	.365	1.000	-.001
Vehicle	.073	.049	-.129	-.001	1.000
Dimension	1	2	3	4	5

Correlations Original Variables					
	H.H size	worker	incm	Student	Vehicle
H.H size	1.000	.668	.414	.554	.073
Worker	.668	1.000	.208	.224	.049
Income	.414	.208	1.000	.365	-.129
Student	.554	.224	.365	1.000	-.001
Vehicle	.073	.049	-.129	-.001	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.251	1.090	.815	.619	.225
Correlations Transformed Variables					
	H.H size	Worker	income	Student	Vehicle
H.H size	1.000	.996	.243	.704	-.013
Worker	.996	1.000	.238	.698	-.015
Income	.243	.238	1.000	.349	-.046
Student	.704	.698	.349	1.000	-.019
Vehicle	-.013	-.015	-.046	-.019	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.737	1.012	.884	.363	.004
Model Summary					
Multiple R	R Square	Adjusted R Square		Apparent Prediction Error	
.998	.995	.995		.005	
Dependent Variable: trips; Predictors: hhsize worker incm student vehicle					

The above table of correlation original variable shows that there is a linear correlation among the independent variables ranging between 0.073 and 0.668 indicating that there exist a relation of multi colinearity among the chosen variable.

9. Trip generation model for zone 9

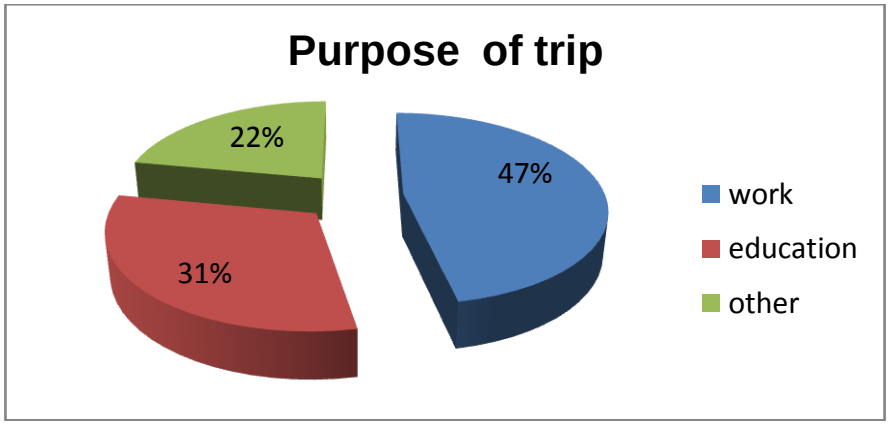
Correlations Original Variables					
	H.H size	Workers	income	Vehicle	Student
H.H size	1.000	-.045	-.103	.607	.490
Workers	-.045	1.000	.107	.046	.073
Income	-.103	.107	1.000	.200	-.046
Vehicle	.607	.046	.200	1.000	.416
Student	.490	.073	-.046	.416	1.000
Dimension	1	2	3	4	5
Eigenvalue	2.015	1.161	.937	.566	.321

Correlations Transformed Variables					
	H.H size	Workers	Income	Vehicle	Student
H.H size	1.000	-.723	-.092	.183	-.125
workers	-.723	1.000	.008	.028	.160
Income	-.092	.008	1.000	.089	.068
Vehicle	.183	.028	.089	1.000	.220
Student	-.125	.160	.068	.220	1.000
Dimension	1	2	3	4	5
Eigenvalue	1.787	1.264	.966	.744	.239

Model Summary			
Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.780	.609	.456	.391
Dependent Variable: trips; Predictors: H.H size worker's income vehicle student			

The above table of correlation original variable shows that there is a linear correlation among the independent variables ranging between -0.046 and 0.607 indicating that there exist a relation of multi colinearity among the chosen variable.

IX. PURPOSE OF TRIP OF ALL ZONES



X. TENTATIVE ROUTES DECIDED ON BASIS OF TRAVEL DEMAND

Route 1: zone 1 to zone 5

This two zones have the longest trip length in all 9 zones, as the travel demand in this zone are also high during peak hours so this route can be selected as this route covers zone 1, zone 2, zone 3, zone 6 and zone 5.

Route 2: zone 2 to zone 5

These two zones have trip attracting points such as railway station, st Stephen school, GIDC etc so travel demand will be more on this route.

Route 3: zone 3 to zone 9

These two zones include market area, residential area, and commercial and education area so travel demand will be more. The black spot on the map indicates the bus stop point for different zones decided as per space and accessibility for different society with respect to their zones

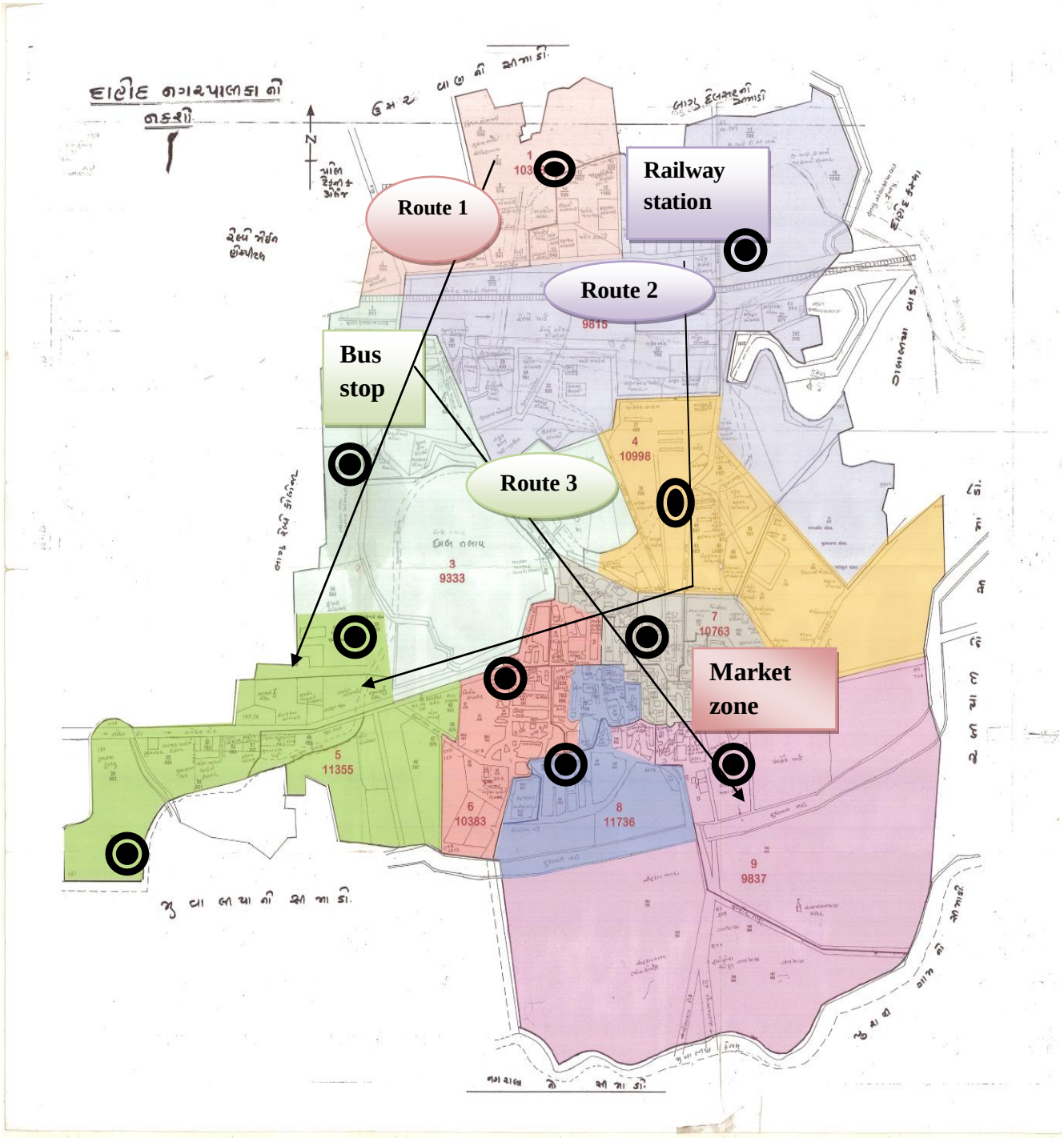


Figure 3: tentative routes for city bus

XI. CONCLUSION

After analyzing the data it can be concluded that the trips having distance 5 or greater than 5km have more frequency as the major center points of Dahod city such as government engineering college Dahod, government polytechnic Dahod, arts, commerce and science college, seva sadan district court are situated on such large distance ,the school which are situated in the city itself have distance more than or equal to 4 km or 5 km from different zones ,the center points have generally work trips and education trips.

Future scope such as fare structure and scheduling of the city bus service can be carried out, so it can be concluded that the public transportation system is feasible for Dahod city. It will provide great help to student and workers for their work and education trip.

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