

Karjat Taluka Public Transport: Infrastructure, Demand and Supply

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Contents

1	Overview	3
2	Introduction	4
2.1	Transport Supply Chain	4
2.2	Elasticity of Price and Services	4
2.3	Overservice and Underservice	5
3	Objectives	6
4	Stakeholders	7
4.1	Minidors	7
4.2	MSRTC	8
4.3	Vans	8
4.4	Auto Rickshaws	9
4.5	People (or Consumers)	9
4.6	RTO and Other Governing Bodies	10
5	Framework and Methodology	11
5.1	Service Unions	11
5.2	Infrastructure	12
5.3	Conceptual Framework	15
5.3.1	Primary Data Collection	15
5.3.2	Secondary Data Collection	17
5.4	Analysis	23
6	Suggested Future Work	25
6.1	Useful Contacts	26
7	Closure	27
8	Acknowledgement	28
9	References	29

1 Overview

The taluka (sub-district) of Karjat is a part of the Raigadh district, to the east of Mumbai City region. This region first came under the threat when Mumbai was becoming a metropolis, and many people migrated from here to the city. This resulted in low socio-economic performance in the region. Now the same region is being threatened by urbanization. Thus, Karjat has become a hub of social, economical and political problems. This makes Karjat an ideal location for the study of rural issues like transport infrastructure and services, serving as a ground from where a model can be built to solve problems in other rural areas of India.

The objective of the study is to understand, model and suggest measures to improve the service, infrastructure and the conditions of the transport system. This study aims to understand and analyse the transport needs and their satisfaction at whole taluka level and its principal towns. Briefly the study maps the most populous regions and tries to draw a backbone out of it. Also, a plan to make case study to understand the human supply chain for multimodal transport in a couple of chosen hamlets has been laid down. The transportation needs will be analysed from the same. The case study will largely focus on road transport for people, as opposed to movement of goods.

The outcome of the study will be a report which will present the status of the major demand and supply points, road infrastructure, and the operations of major service providers, costs and benefit analysis from the perspective of the traveller and the service provider.

2 Introduction

Public transport is an important need of the society, primarily for its socio-economic development. It enables workers to commute for the livelihood, students pursue greater and better education, for the purchase and selling of goods. An ideal public transport is often characterized by low economical fare, reliability and safety. Such service may be provided by public (Government) or private parties. The regulation is the responsibility of the State.

The Karjat taluka, though a small region is largely divided in the service and satisfaction received from the current Transport System in the region. There is a mixture of transport services in the region, comprising of MSRTC buses, 6-seater minidors, 3-seater auto rickshaws and 6-seater vans. Union differences, uncertainty and assymetry of public demand, safety hazards especially because of overloading of human carriers are some of the problems that have to be overcome with a optimized solution.

This study has been conducted so as to understand and analyse the following in the taluka of Karjat:

2.1 Transport Supply Chain

Karjat taluka, like anywhere else, also has its transportation supply chain network. The main junction and collection points are that of Kadav, Kashele, Neral, Kalamb, Khandas-Nandgaon, Kothimbe and Karjat. People from nearby villagers move to the nearest junction or to a point in the route between any two junctions, mostly by walking. Once they reach one of these places, they can travel to their destination from here, likely through bigger junction points. On every main route, there are many tertiary feeder networks. We have tried to do a tertiary feeder analysis on as many routes as have been possible.

2.2 Elasticity of Price and Services

Currently, the fares of all public transport services are reasonable, possibly even lower. However, this lower fare and inadequate organization and planning, the other two features of the public transport system, namely safety and reliability pay a heavy toll. This is a cause of reasonable concern. Another secondary feature that also has also been neglected is comfort.

Elasticity is an economist's term. It is the ratio of the percentage change

in a dependent variable to a percentage change in an independent variable. Here the dependent and the independent variables are QoS (Quality of Service) and the fare. QoS primarily includes safety, reliability and comfort. However the elasticity in this transport service is also influenced by other lesser measurable factors like the extent of planning and organization. This study has also aimed at understanding the current price rate scenario in the local agents of transport, and how they are related to the MSRTC bus fares.

2.3 Overservice and Underservice

The current scenario has been studied, and the amount of service provided on a route has been mapped. This has been done especially for all main stream routes in the taluka. At certain places, there are not enough service vehicles to meet the public demand, as a result of which problems like prolonged waiting time, poor economic performance in the area occur. These are areas where the transport needs are under-serviced. In several others, there are many more vehicles servicing than necessary. This results in fewer trips conducted on a per auto basis, and creates an over-serviced transport system.

3 Objectives

The ultimate objective of this project would be to provide an optimized plan in which the contentness, efficiency and profitability of all the services and the serviced reach at its peak. The objectives of this study is to understand the transport supply chain; aquire and plot data related to the transport issues in the Karjat region. These graphical data would then be further used to solve several issues related to transport planning and development in the sub-district. The objectives of this study are:

- The penetration of MSRTC transport system will be compared to the other subsidiary transport mechanisms in the region and the correlation in the quality of service and fares between the two will be done.
- Identify routes on the basis of whether they are over-serviced or under-serviced by either or all of the available transport mechanisims.
- Service expenditure and a cost-benefit analysis in different routes with respect to MSRTC and Minidors.
- Identification of external issues that affect the performance of one or more services, and suggesting possible solutions to address them.
- Collection of data, primary or secondary which could be useful in addressing future problems in the taluka transport.

4 Stakeholders

A stakeholder is a person, group or organization who would get affected by or would affect the execution of a project, which in this case being any change in the current transport structure. The basic idea would be to put the maximum number of stakeholders (if not all) to be profited by the changes. It should be in the positive interest of everybody.

Identification of the stakeholders was the first step of action undertaken. Karjat taluka transport, as said earlier, is managed by many different agents. Any plan or proposal made should at least be acceptable to the key stakeholders. The key stakeholders, which mainly comprise of the service providers in the region, have been identified as follows:

4.1 Minidors

The minidors are 6-seater vehicles, and based on its network and scale of operations, it can perhaps be called the single most important stakeholder in the region. These vehicles are 3 wheelers and are registered to seat 6 passengers at one time.

Minidors are there in almost every important nodal point in the taluka. Out of the investigated junctions, minidors are plying abundantly to and from Neral, Kashele, Khandas, Nandgaon, Beed, Khopoli, Jamrung, Konivale, Kothimbe and Karjat. Some of these routes are shared by other stakeholders. The most significant rival stakeholder in most of these routes is the MSRTC buses. However, in some parts minidors have become a more preferred choice for the travellers. In every place, there seem to be abundant minidors to meet the public demand. In most places, the the number of minidors are much more abundant than the public demand.

These minidors are operated mostly under the administration of the unions. The unions are characterized by their control and regulation being restricted to only one or a few routes which are operated by the minidors. Every union is independent in its working, and no vehicle under its regulation can ply on a route that is outside its reign.

These are privately owned vehicles and apart from the little help they might get from the unions, they have no security. In spite of being registered to seat 6 passengers, the minidors seat atleast 10-12 passengers before making a start for the destination. Three on the front seat by the driver, 5 on each of the

backseats. Delayed waits for the vehicle to fill in before departure are very common.

4.2 MSRTC

The Maharashtra State Road Transport Corporation (MSRTC) is the second most important stakeholder, after the minidors. MSRTC is one of the most successful Road Transport Corporations in the country. It was set up Karjat Bus Station, which is located very close to the Karjat Railway Station in Karjat City is the main bus stand in the taluka of Karjat, and a very important one in the State of Maharashtra. However, on account of this study, we are interested only in the local bus services.

Buses connect every important junctions of the sub-district: Neral, Khopoli, Kashele, Kalamb, Khandas, Nandgaon, Beed, Jamrungi, Konivale, Kothimbe and Karjat. However, in most of the places the service is inadequate in terms of low supply and reliability for in-time operation. In some route there only one or two buses plying on a daily basis, which would be clearly inadequate.

There fares are obviously standardized as per MSRTC norms, and depending on their service quality, determine the fares of other modes of alternate transport. Minidors plying on routes with good MSRTC service have lower fares, whereas if the service is bad, minidors have higher fares. MSRTC gets subsidies from the State for operating in this region. This subsidy is the amount needed to overcome the cost deficit in plying from place to place. This enables the bus service operations to become loss resistant, so it can run even if there is lower demand than supply, to meet the needs of basic commutivity.

4.3 Vans

Vans comprise a different section of vehicles, Omnis, Tavera, Sumo etc. These vehicles in most parts of the taluka have started plying only like a half a decade ago, from when people started buying old vehicles from Ulhasnagar and surrounding areas. These are primarily four wheelers which have been perhaps slightly altered from their insides to enable them to function like 6 seaters. Most of these vehicles are unregistered with the RTO, and survive on the bribes they pay to the local policemen regularly.

Motorized vans do not have any monopolized route. They are often in com-

petition not only with the MSRTC, but with minidors as well. Minidors and vans generally share a common stand, with a common queue. Though they operate in collaboration with the minidors, the minidors are unsecure, mainly because the performance of these vans are superior. Besides, even people prefer vans over minidors because of better service quality.

4.4 Auto Rickshaws

Auto rickshaws are three seaters, that ply in routes where there is lesser demand. Some of these are registered, but to carry only three passengers at one time. There are rickshaws who do shorter routes, and some of the non modal routes as well, covering shorter distances. These are characterised by the fact that they do different routes every time, as per the demand. These vehicles are not registered at all, but important to the public all the same.

Auto rickshaws have taken monopoly in the private transport sector in routes around Kalamb. There are rickshaws at Kashele and Neral as well, but these serve the Kalamb routes, and also routes to some of the surrounding villages. There are local rickshaws in Karjat City as well, and these do private ferrying (serving one passenger or group). The fares are irregular, and most vehicles are unregistered. Quite a few vehicles are without permits as well.

4.5 People (or Consumers)

The other kind of stakeholders are the people. They, unlike the service providers, are the service takers. The entire transport system is only built to help the people for their daily work, and provide them more opportunities, by bridging the communication gap between distant places. Hence they are also a key stakeholder, and by no means, their demands cannot be neglected.

The transport system is not only dependent on the financial condition of the people, but also it affects the financial conditions of the people. Workers are most abundant among various categories of travellers at Karjat. The performance of the businessmen, traders and workers of the region are greatly affected by the transportation facilities. Transportation is also vital to meet the people's educational, market, travelling and medicinal needs. Educational centers, beyond primary school have developed at Karjat, Kashele and Neral, which are quite the modal points in the transportation skeleton. These places are also markets where farmers sell their crop, bricks are sold to agents and so on. When the important taluka junctions fail to meet the market needs, the people have to resort to travel to outside the taluka, to

places like Ulhasnagar.

For one thing, passengers should define the timings for carriers, especially MSRTC buses. People need to reach on time especially if they are workers or students. Another important transport system parameter affected by this stakeholder is the fares. People have an idea of what is a 'reasonable' fare, and won't be willing to pay beyond that. The study of this stakeholder is the most complex.

4.6 RTO and Other Governing Bodies

These bodies have a key role to play in taking care of legal, environmental and safety issues related to vehicles. In the current scenario, their most policies have been greatly compromised, for the benefit of the people and the service providers. Any proposed solution should try to do away with this compromise, and impose greater control of the RTO over the service providing vehicles. The good solution would be such that it is beneficial for the service providers, the passengers and satisfy the RTO and other legal norms as well.

5 Framework and Methodology

This the bare ground we have to build on, to make the region's transport sytem more efficient, profitable, safe and comfortable fr the people. The region is not very economically flourishing due to various reasons, as a result of which it is not very easy for the service providers to profit from the nominal fee they charge the passengers for travel. This is the main reason, that they seat 12 passengers instead of 6 in a minidor, to make the journey more viable.

5.1 Service Unions

There are several disjoint unions each regulation a small set of routes. Most of these unions are in fact, so small that they regulate just one route. The service providers or drivers are loyal to their union, and follow the norms set down by them. The unions are also known to be of certain help to the service providers, especially in terms of financial needs and resolving discrepancies at perhaps a regular monthly nominal membership fee of less than Rs. 200 (varies from union to union). The unions, thus form an adequate representation to their corresponding services community. They will play an important role in optimization and planning of the transport sector.

Most of the bigger unions are purely political in nature, determined by the ruling party. At some places, there is a reasonable conflict of interest between two unions, as a result of which both, or one of them has to suffer economic loss. For instance, there are two differnt unions, operatingon the Karjat-Kadav-Kashele route, one from Karjat, the other from Kashele. The service vehicles in either of the two unions are barred from picking up passengers from the stands of the other union, thus resulting in certain empty travels.

Most of the unions are named on the routes they ply. The most important unions however, have beter reognition,and are as follows:

1. Sri Ram Pul Union (Karjat)
2. Bal Digambar Union (Kadav)
3. Hari Om Minidor Chalak Malak Sanghatnam (Kashele \implies Karjat)
4. Karjat Rickshaw Chalak Malak Sanghatna (Karjat Town)
5. Vishegaon Minidor Chalak Malak Sanghatnam (Vishegaon, Karjat)

6. Neral Kashele Chalak Malak Sanghatnam (Neral \iff Kashele)

Kalamb area is without any centralized union. Most lesser known unions are private, and they have no union leader as such.

5.2 Infrastructure

The current infrastructure is an integral part of the problem framework. One of the main items in this category are the roads. The current road network, along with the quality of roads, plus the development, widening and expansion plans for the roads are both included. The basic necessity of an all season route between villages are more or less already met. However, the concrete roads in certain areas have not been repaired for months, and thus have worn out considerably. This is quite inconvenient for travel, especially in the case overloaded service vehicles.

The different category of roads in the taluka are:

1. Rashtriya Mahamarg
2. Drutagati Mahamarg
3. Pramukh Mahamarg
4. Rajyamarg
5. Pramukh Zilamarg
6. Itar Zilamarg
7. Grameen Marg

The important roads of Karjat Taluka are Rajyamarg. The road map, as per the Raigad district website is shown in figure 7.

The other important component of the infrastructure are the main modal points or junctions from where most of these services originate, and are connected among themselves by roads. The most important modal point is Karjat City, which also has a railway station, from where it is connected to Mumbai and Pune. The other junction points with railway stations are Neral and Khopoli. Kashele is the most important interior modal point as it is connected to Karjat-Kadav, Neral, Kalamb, Khandas-Nandgaon, and Kothimbe, which cover almost all of the Karjat taluka. Other nodes of importance are Jamrung, Sugave and Kondiwade. These are the points where

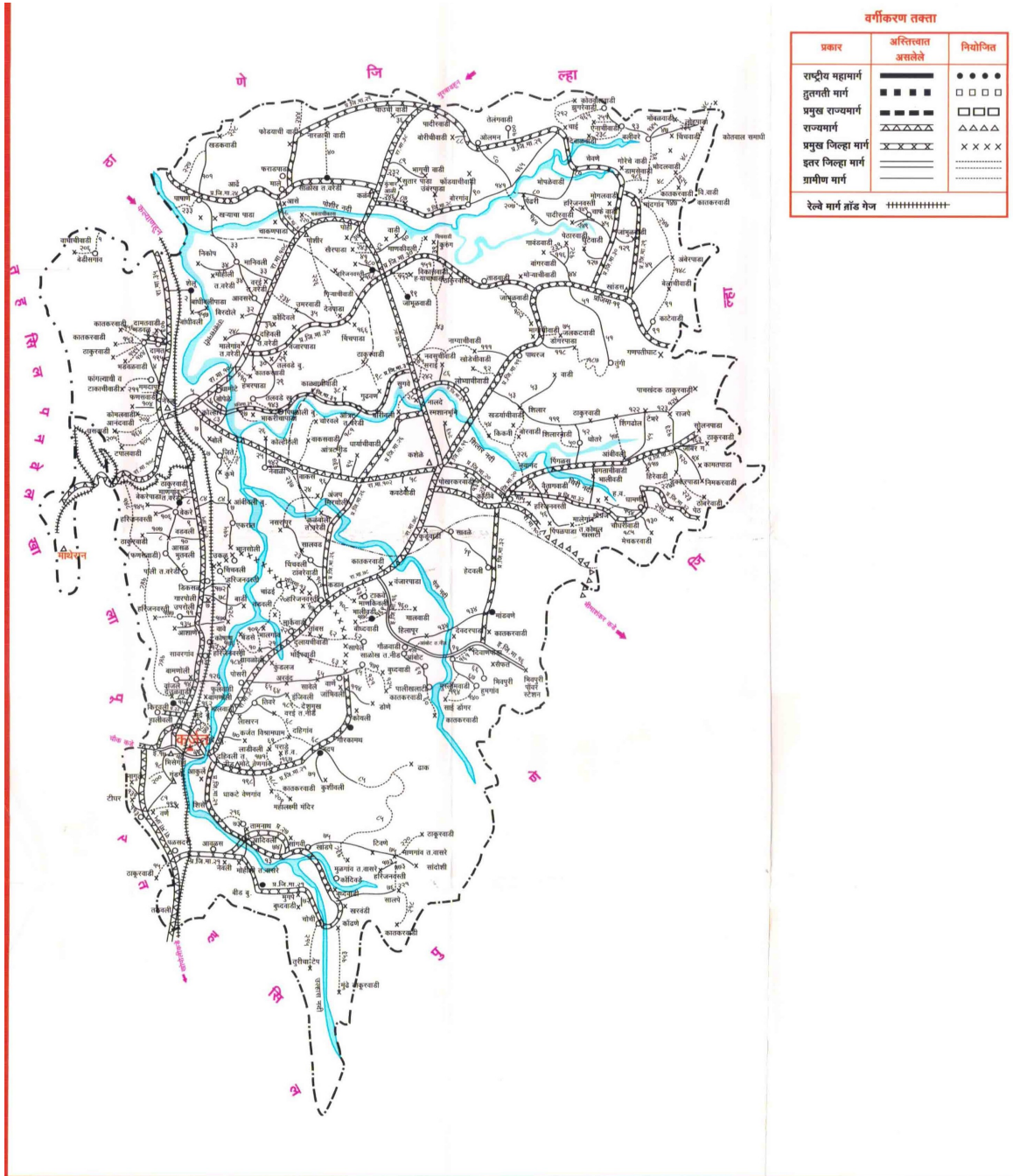


Figure 1: Karjat: Primary and Secondary Road Network

Modal Point	Road Connectivity		Transport Service			Comments
	Primary	Secondary	Railways	MSRTC	Private/Union	
Karjat	Kadav Kashele Ambivalli	Gaurkamat Vadap	Yes	Yes	Yes	Also has local transport
Vishegaon	Bhivpuri Vashi Khopoli		Yes	Yes	Yes	Is just outside Karjat
Kadav	Kashele Karjat	Vadap Gaurkamat Potelpali Khedegaon Mandavni Vinegaon	No	Yes	Yes	
Kashele	Karjat Neral Kalamb Kadav	Khandas Nandgaon Kothimbe Pathraj Sugave Jamrung	No	Yes	Yes	Most important junction
Neral	Kalamb Kashele	Pimpoli Kondivale Poshir Damat Bhadval	Yes	Yes	Yes	
Kalamb	Neral Murbad Kashele Mhasa	Dahiwale Poshir Pashane Wangani Sugave Bhandiwali Mali	No	Yes	Yes	Important Junction in the north

Figure 2: Karjat: Primary and Secondary Road Network

the transport supply chain converge to higher levels.

The table 2 shows the linking of various primary modal nodes with each other, and with smaller hamlets through secondary routes. The connectivity via the three main agents of transport, namely the railways, state buses and the private or the unionized service vehicles like minidors, auto rickshaws and vans is also shown in the table.

5.3 Conceptual Framework

Conceptual framework will be used to outline possible courses of action or to present a preferred approach to quantify the transport issues. For realising the objectives we need had to collect some data in primary form, and some in secondary form.

5.3.1 Primary Data Collection

The primary data collection consists of two stages, one stage covers the perspective of different stakeholders that are on the side of service providing, and also try to understand the intricate details of demand and supply. The other one tries to understand the transport framework within the taluka.

1. Service Patterns

Information about the routes where public transport is applicable in the taluka. Along with the routes, the kind of vehicles that ply on that route also need to be known. The size of the fleet operating on route needs to be known too. Other information regarding the service vehicles that need to be known are the fares, vehicle maintenance issues, passenger capacity (registered and followed both), incomes of the service providers (divided into revenues, profits and other maintenance costs, the relationship between the service providers and the union leaders. This along with their personal satisfaction and their perception of the passengers need to be known. Table 3 shows the data that we collected on our trips. The structured analysis of their revenue collection is shown in Table 4. The passengers served on each route is shown in Table 5.

2. Road Network

This consists of finding out the number of passengers and vehicle trips done on the road on a per day basis. Using these figures, we want to identify which are the more important routes, and which are the less important ones. Also, we would like to observe the flow of passengers from the tertiary routes, into the main inter-modal primary routes. The primary and secondary road network is shown in table 2. Also, the flow of passengers can be determined by the availability of facilities within the taluka. Though the city of Mumbai is quite near and provides much better products and opportunities than that in the taluka, people cannot travel regularly to the city for their every need. The scene of the available non transport related facilities are shown in table 6.

Link	Type	Vehicle	Fare	Distance (km)	Trips/Day /Direction	Fleet Size	Passengers/ Trip	Passenger Waiting Time
Neral - Kalamb	Rajyamarg	15	3 seaters	15.0	40	12	6	30
Neral- Kashele	Rajyamarg	15	6 seaters	11.2	105	45	12	15
Kalamb- Kashele	Rajyamarg	15	3 seaters	12.0	90	30	6	45
Kashele - Kadav	Rajyamarg	10	6 seaters	7.2	120	35	12	30
Karjat - Kadav	Rajyamarg	10	6 seaters	7.4	100	120	12	30

Figure 3: Karjat: 3/6-Seater Service Analysis

Route	Fare	Vehicle	Daily Fuel Charges	Monthly Repairs	Daily Revenue
Neral - Kalamb	15	3 seaters	200	1000	500
Neral-Kashele	13	6seaters	250	3000	600
Kalamb-Kashele	15	3 seaters	200	1000	450
Kashele - Kadav	10	6seaters	250	2000	600
Karjat - Kadav	10	6 seaters	250	2000	600

Figure 4: Karjat: Cost Benefit Analysis

Route	Vehicle	Fare	Passengers
Neral - Kalamb	3 seaters	15	480
Neral-Kashele	6seaters	13	2520
Kalamb-Kashele	3 seaters	15	1080
Kashele - Kadav	6seaters	10	2880
Karjat - Kadav	6 seaters	10	2400

Figure 5: Karjat: Passengers Analysis

Modal Point	Facilities				
	Market	Hospital	Education	Work	Junction
Karjat	Yes	Yes	Yes	Yes	No
Vishegaon	No	No	No	No	Yes
Kadav	Yes	No	No	Yes	Yes
Kashele	No	No	Yes	Yes	Yes
Neral	No	No	No	No	No
Kalamb	No	No	No	Yes	Yes

Figure 6: Karjat: Primary and Secondary Road Network

These numbers are not exact figures, but are close estimates that we could gather after talking to 2-5 (average 3) service providers, *i.e.* drivers per route. The numbers do not include *hafta* which has to be regularly (in some cases it is irregular as well) paid by all the vehicles for over loading their limits, and sometimes for the vehicles not being registered with the RTO. Some problems that we discovered during our survey, but though it was outside our scope to address them. These included,

- Some unions had political differences, and hence they refuse to provide service in collaboration. For example, Karjat and Kashele have NCP and MNS-Sena unions respectively, and hence they do not allow the vehicles of the other union to pick passengers from their stand/
- Petrol and diesel prices are high as there are not petrol pumps in the taluka other than Karjat Town. The rates were Rs. 80 per litre for petrol in Kashele and Neral when we asked, as sold by private shops. Also, this petrol comes with a lot of adulteration.
- Non availability and poor quality of vehicle parts burden the expenditure of service providers.

5.3.2 Secondary Data Collection

Some pre-calculated data would also be needed for the analysis. The need for secondary data collection arises due to two reasons: Collection of such data is inexpensive and inexhaustive; and quality data is already available elsewhere. The following data was collected during the entire period, some of which does not have much application with our study, but can be very

well useful for future studies in related to the Karjat transport scenario, or transport service in general.

1. Census Data and Maps

- Topographical maps, in order to get the road map of the taluka, along with the quality of roads between two nodal places.
- Population density maps, this is required to identify the most populous regions in the taluka and thus enabling us to give greater importance for improving connectivity in such regions.
- Census data, with detailed distribution of population of each hamlet in the taluka, in terms of employment, sex, children and total. There is also a need to know from the census data, the nearest locations of markets, hospitals, bus, minidor and train stations.
- Location of important places, like schools, universities, hospitals, markets, employment areas amongst others in the taluka.

The census data for the Karjat Taluka was available through the online repository maintained by CTARA, IIT Bombay. It gave us necessary data of the population of Karjat taluka, growth of population over the years, sex-ratios and population densities of the Taluka. The census data available to us was the 2001 census population data.

The population densities of various hamlets inside the taluka were studied to identify the major hamlets inside the taluka with significant population densities. These were taken into prime consideration to understand and study the primary and tertiary routes for road transport. Apart from this topographical maps were printed out from Google Maps which were carried during field trips and used to identify and mark hamlets and other important routes and landmarks. Primary and supporting tertiary routes were marked for further study.

2. MSRTC Data

- **Trip Report for the month of March 2011 for Routes of all types and Buses of all types**
This includes number of passengers served per route, earnings, operated kilometres and departure times, samples of which are shown in Table 9 and 8

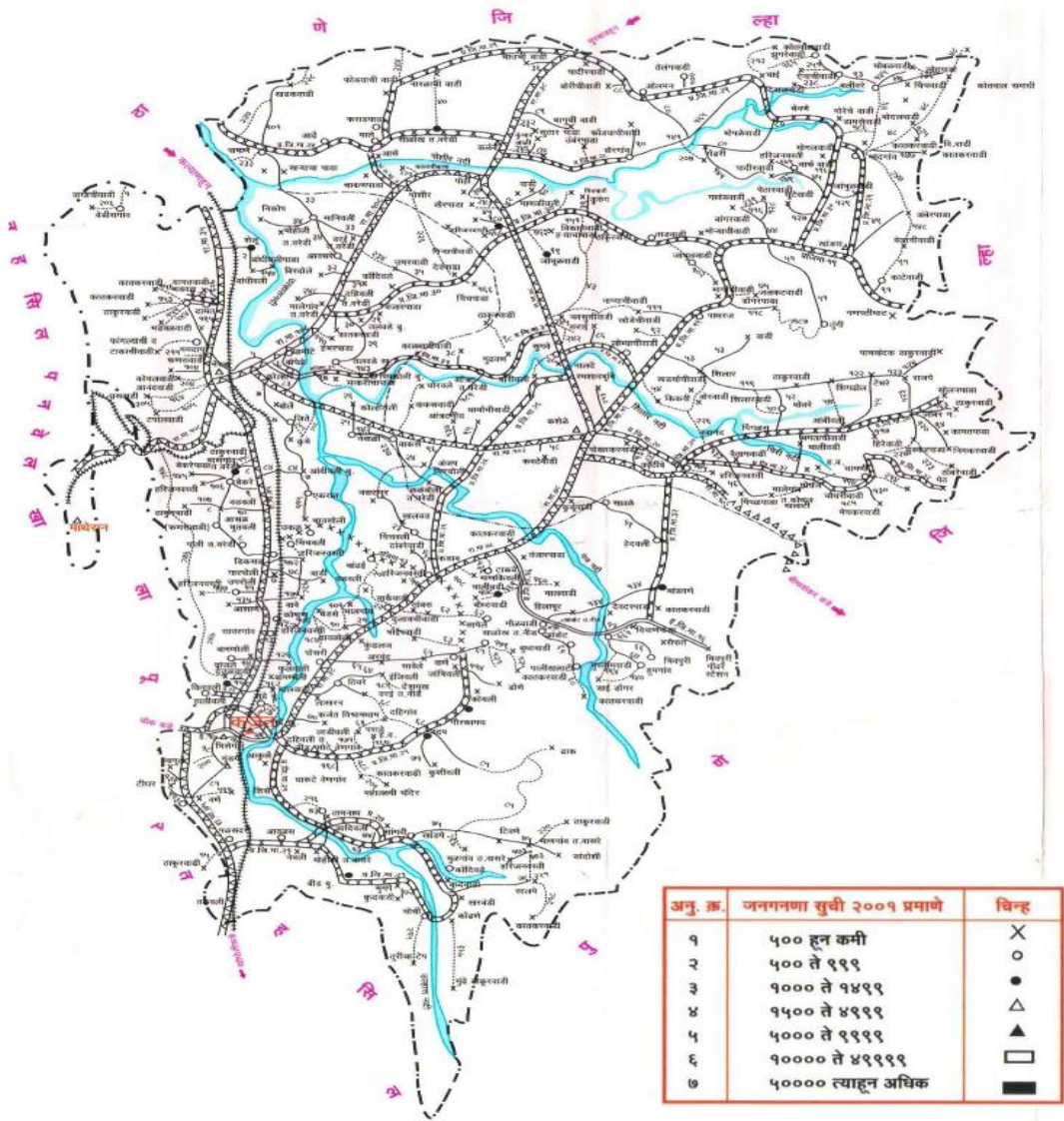


Figure 7: Karjat: Population Distribution

Sr No	Trip Number	Route	DepthTime	Kilometer	Operated Trips	Operated Kilometers	Psgs Earning	Net Earning	Expt Earning	% Load Factor	Net EPKM	No Of Psgs
23	S53025	NERAL to KALAMB	21:45:00	12.7	30	381	6365	6152	12978	49.04	16.15	996
120	S53152	NERAL to KALAMB	15:30:00	12.7	11	139.7	1892	1829	4815	39.29	13.09	270
130	S53162	NERAL to KALAMB	09:30:00	12.7	28	355.6	10986	10683	12204	90.02	30.04	1432
158	S53192	NERAL to KALAMB	17:15:00	12.7	16	203.2	3518	3402	6849	51.37	16.74	466
297	S53346	NERAL to KALAMB	14:30:00	12.7	22	279.4	3655	3539	9513	38.42	12.66	535
299	S53348	NERAL to KALAMB	16:00:00	12.7	27	342.9	5503	5322	11484	47.92	15.52	724
303	S53354	NERAL to KALAMB	20:15:00	12.7	28	355.6	10190	9852	11961	85.19	27.71	1561
96	S53108	NERAL to KARJAT	08:30:00	16.2	29	469.8	3172	3075	15180	20.9	6.55	562
121	S53153	KALAMB to NERAL	16:05:00	12.7	11	139.7	1663	1611	4815	34.54	11.53	279
131	S53163	KALAMB to NERAL	10:05:00	12.7	27	342.9	5893	5714	11808	49.91	16.66	785
159	S53193	KALAMB to NERAL	17:45:00	12.7	15	190.5	1278	1236	6453	19.8	6.49	190
298	S53347	KALAMB to NERAL	15:10:00	12.7	21	266.7	3061	2984	9072	33.74	11.19	370
300	S53349	KALAMB to NERAL	16:40:00	12.7	28	355.6	4962	4797	11925	41.61	13.49	785
304	S53355	KALAMB to NERAL	06:00:00	12.7	29	368.3	9719	9392	12321	78.88	25.5	1417

Figure 8: ABC Analysis of some chosen important routes in the taluka, where the service quality of the MSRTC is poor, and people mainly rely on the alternate modes of transport.

Sr No	Trip Number	Route	DepthTime	Kilometer	Operated Trips	Operated Kilometers	Psgs Earning	Net Earning	Expt Earning	% Load Factor	Net EPKM	No Of Psgs
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130	S53162	NERAL to KALAMB	09:30:00	12.7	28	355.6	10986	10683	12204	90.02	30.04	1432
158	S53192	NERAL to KALAMB	17:15:00	12.7	16	203.2	3518	3402	6849	51.37	16.74	466
297	S53346	NERAL to KALAMB	14:30:00	12.7	22	279.4	3655	3539	9513	38.42	12.66	535
299	S53348	NERAL to KALAMB	16:00:00	12.7	27	342.9	5503	5322	11484	47.92	15.52	724
303	S53354	NERAL to KALAMB	20:15:00	12.7	28	355.6	10190	9852	11961	85.19	27.71	1561
96	S53108	NERAL to KARJAT	08:30:00	16.2	29	469.8	3172	3075	15180	20.9	6.55	562
121	S53153	KALAMB to NERAL	16:05:00	12.7	11	139.7	1663	1611	4815	34.54	11.53	279
131	S53163	KALAMB to NERAL	10:05:00	12.7	27	342.9	5893	5714	11808	49.91	16.66	785
159	S53193	KALAMB to NERAL	17:45:00	12.7	15	190.5	1278	1236	6453	19.8	6.49	190
298	S53347	KALAMB to NERAL	15:10:00	12.7	21	266.7	3061	2984	9072	33.74	11.19	370
300	S53349	KALAMB to NERAL	16:40:00	12.7	28	355.6	4962	4797	11925	41.61	13.49	785
304	S53355	KALAMB to NERAL	06:00:00	12.7	29	368.3	9719	9392	12321	78.88	25.5	1417

Figure 9: ABC Analysis of Kalamb-Neral route, which has a much better service quality from the perspective of the people, than other routes in the taluka.

- **Account Head-Wise Distribution Report for the month of March 2011**

This includes revenue drawn from various account heads like normal passengers, luggage, senior citizens, and season tickets.

- **Pure Extra Trip Earning Report for the month of March 2011**

This includes earnings made by ST buses when they made extra trips out of their schedule.

- **Summary Of Daily Cash Collection Report For Month March 2011 (Conductor)**

This includes net amount collected by conductors through luggage and tickets everyday throughout the month.

- **Passenger Travelled Report for a day - 02-04-2011**

- **Passenger Travelled Report for a day - 05-04-2011**

This includes data of number of full ticket passengers, half ticket passengers, and concession passengers travelling on different bus types. We took the data for two days separately - one a weekday and the other a weekend as we expected different travel patterns during weekdays and weekends.

- **Service Type Wise Earning Report For Date 04-04-2011, All Services And For all Routes**

This includes the route wise data depicting the revenues (luggage and passengers separately) along each route, route length, number passengers served, total revenue along with the service type on that route.

- **Travel Link Data, January 2010 (Hard Copy)**

This included the travel link data which explained the number of buses along all routes in the Karjat taluka and how they cover all the routes during the day.

Data from governing bodies formed an important segment of the secondary data collected. These were mainly pertaining to the ST buses data collected through MSRTC. Data was required to compare fares, passengers served and other service statistics of ST buses with the 6-seaters and other modes of transport along the primary and tertiary routes identified. Permission for acquiring such data was first taken through CTARA, IIT Bombay by sending a letter to the concerned authorities at MSRTC.

The data we obtained elucidated all the passenger earnings and passengers served along around 380 bus routes for an entire month, which would be adequate for our analysis as the data follows a similar trend through out the year. We were guided by the computer personnel to a database computer connected to a main server located elsewhere. The database machine was specifically used to extract data and reports pertaining to functioning of ST buses in the Taluka in various forms. We went through their entire system to extract all kinds of reports for data that we thought could be relevant to our project.

5.4 Analysis

Google mapping as shown in figure 10 was done especially in order to measure the actual distances between two serviced places, and it gives a very clear and an original view of the entire transport scenario.

The more profitable routes of MSRTC are classified as A, followed B and C, which are lesser profitable. In fact most of these routes run on subsidies received from the state. It would not be easy to remove the stakeholdership of the MSRTC altogether, because it plays a very important role in price regulations. On the Karjat-Kadav-Kashele route which has been a victim of irregular bus service from MSRTC, has very high minor rates on per kilometer per passenger basis. Whereas, the Khandas-Neral route has a much lower minor rate on per kilometer per passenger basis because the service of MSRTC is better. It is also seen that old people (senior citizens) prefer the bus over minidors mainly due to the way so many people are stuffed into the vehicle.

The routes of Karjat-Kadav-Kashele and the tertiary routes are all over serviced. There are several stand vehicles, that makes up a queue time of up to three hours everytime to be able to ferry passengers from one place to another. Thus, the routes are over serviced, and it would do good to use a lesser number of vehicles at that stand. However, it is unclear how the number of vehicles at a stand can be reduced.

Within Karjat town, there are problems of non-standardized fares, and way too many auto rickshaws. Also, a few rickshaws (estimated to around 100) were recovered from scrap, and not only they are without permits and registration, it could be very unsafe for passengers, and polluting as well.



Figure 10: Google map of the Karjat taluka with hthe main towns and routes marked.

6 Suggested Future Work

1. Traffic Analysis

For a link between two modal points, the traffic needs to be well understood. Understanding the traffic would include observing the minidor stands at both modal points around the same time of the day. The intervals at which the service vehicles leave the stand, the wait time for the vehicle in the stand queue to get its chance, and also monitor the kind of people who undertake the travel. This analysis should be done for all possible alternate modes of transport between the two modal points as well. MSRTC and minidors will be considered primarily in the Karjat taluka. This analysis should also be separately done for tertiary roads, and in the main backbone roads.

2. Public Demand Analysis

This would include a survey of two neighbouring villages in order to map in intricate detail, their needs for transport, preferences and expectations of QoS of the same. This survey is essential to categorically map the public demand. Every household would be interrogated with a pre decided set of questions to understand the price and QoS elasticities.

3. **Demand and Supply Analysis** The primary data obtained from the Public Demand Analysis would enable categorization of passengers on the basis of their purpose of travel. From the same survey we could also get time frames when people are not likely to travel. There is also secondary data from the unions about the service vehicles that ply on given days. Traffic analysis data would also be used to map frequencies and time intervals of operation. Quantifiers for passengers according to their types, and also the time frames and days when they choose to travel will be dened. Quantifiers for service vehicle data covering their operational fleet size, time frames and intervals of operation will be dened as well. The former variable when plotted against the second, we get the demand-supply graph. Such graphs would be plotted for all the alternate methods of transport as well.

4. **Quality of Service Measurement** The Quality of Service (QoS) is an important parameter to understand the expectation of the travellers and the service providers to some extent as well. QoS is a measure of goodness in terms of primarily four dimensions listed below. However, it should be noted that QoS is a highly relative term, what maybe a good QoS to somebody, maybe be poor QoS to someone else. We try to talk about the general perception.

- **Safety** The travel in a public service vehicle should not be considered hazardous. Three things can make a journey risky: a badly maintained vehicle, a careless or a badly trained driver, and unsafe roads.
- **Reliability** The assurance that the vehicle would depart and arrive at the correct timings, passengers get charged the correct fare for the journey constitute the QoS factor reliability.
- **Flexibility** People should be able to travel at their time of need. But the service support may not be that generous. The measure of this would constitute exibility.
- **Comfort** People might expect certain comforts during a journey. Some of these could be smooth roads, adequate sitting space amongst others.

6.1 Useful Contacts

Some people were especially interested in our project and were keen to contribute as well. Names and numbers of such people are as follows:

1. Ani Haprure @ Kashele, 7278800565
2. Santosh Balkavde @ Kashele-Karjat, 9271821047
3. Jagdish Kadu @ Karjat, 9011292932
4. Yogesh Harpure @ Kashele, 9420298959
5. Balaram Poshadev @ Neral, 9850276165
6. Rajaram Shelke (Union leader) @ Kashele, 9273247350

7 Closure

By the end of the project the transportation needs, and expectations would be available in graphical representation. The data could then be used for any kind of transport development and planning purpose in the future. It will also highlight a model which could be extend to even a district level and applicable to other parts of the country as well.

We have seen the revenues and the profit/deficit that occurs to the service providers on some of the main routes. From the cost benet analysis, minidors could probably replace the MSRTC bus routes almost entirely, and form a more efficient and regular mode of transport, if it is feasible to divide or transfer entirely the Karjat taluka's share of the subsidy received by the MSRTC. The minidor subsidy system, could perhaps be regulated by the Zila Parishads. In an ideal scenario, there would be a right combination of minidors/vams/autos along with minimal buses, such that no route is monopolised and the fares are kept in control keeping in mind the considerations of the people.

Optimized operational plans can be analysed from the data, and presented to the key stakeholders, especially the minidoor unions. If there is a scope for better management and greater revenue generation, the suggestions would definitely be accepted by them, and put to practice.

The secondary data from the MSRTC bus station can be used as leverage to develop an optimized bus depot planning along seceral routes, not only in Karjat, but elsewhere.

The study of supply chain structure could show the possibility of new routes, or a change in the existing routes. Also, it would be of great assistance to cases of widening of roads, and new concrete road constructions.

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