Project Report TD696

On

M.Tech Project Stage 2

Evaluating state bus transportation of taluka, Thane District Maharashtra

Submitted in partial fulfilment for the degree of M. Tech.

in Technology and Development

by

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Certificate

This is to certify that the M.tech stage 2 report titled "Evaluating state bus transportation of Shahapur taluka, Thane District Maharashtra" prepared by Sunny Johari is approved for submission at Centre for Technology Alternatives for Rural Areas (CTARA), IIT Bombay, Powai.

Signature of Guide

Prof. Milind A Sohoni

CTARA, IITB

Declaration

I hereby declare that the report entitled "**Evaluating state bus transportation of Shahapur taluka, Thane Maharashtra**" submitted by me, for the partial fulfilment of the degree of Master of Technology to CTARA, IIT Bombay is a record of the work carried out by me under the supervision of Prof. Milind A. Sohoni.

I further declare that this written submission represents my ideas in my own words and where other's ideas or words have been included. I have also included my senior work Sudhanshu in literature review whom I have given credit in Bibliography. I have also adequately cited and referenced the original sources. I affirm that I have adhered to all principles of academic honesty and integrity and have not misrepresented or falsified any idea/data/fact/source to the best of my knowledge. I understand that any violation of the above will cause for disciplinary action by the Institute and can also evoke penal action from the sources which have not been cited properly

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Place: Mumbai

Date: 22-06-2020 Signature of the candidate

Acknowledgment

It is a matter of great pleasure for me to submit this report on "**Evaluating state bus transportation of Shahapur taluka, Thane Maharashtra**" as a part curriculum of TD-696 of Centre for Technology Alternatives for Rural Areas (CTARA) with specialization in Technology and Development from IIT Bombay.

I express my sincere gratitude to my guide **Prof. Milind A Sohoni** for guiding me and helping me comprehend the study in a better way. I especially thank Anshu Kant, Sudhanshu and Ramya without whom this study would not have been possible. I also want to thank Jitendra Sir for his constant support in understanding GIS tools and DBMS. I appreciate all my friends for their support.

Date: 22nd June 2020

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Abstract

In this report we look at rural public transport as a development service and ways of representing it, analysing it and its social accounting. This report focuses on finding out the relationship between distance between villages and school and its effect on the education of students. We begin with surveying the literature surrounding public transport and specializing for the case of India and rural Maharashtra. Then we go into how transport is affecting education in rural areas. For this, we have taken Shahapur taluka and Shahapur Taluka bus depot as a case study. We outline the key data formats and the connections between the same. We used GIS software, CensusGIS data and SchoolGIS data as a tool to find out schools for surveying. In this phase we went to these selected schools to find out how the children studying in these Schools and how they are commuting from their home to school and how much percentage distance covered is covered by them is through ST buses to understand the effect of public transport in taluka on education accessibility and finally achieve our objective of increase the social cost-benefit analysis for taluka.

List of Abbreviations

QGIS	Quantum Geographic Information System
MRSAC	Maharashtra Remote Sensing Application Centre
MSRTC	Maharashtra State Road Transport Corporation
GIS	Geographical Information System
PHC	Public healthcare center
ETIM	Electronic Ticket Issuing Machine
DISE	Unified District Information System for Education
OSM	Open Street Maps
PWD	Public Work Department
ST	State Transport
FY	Financial Year
YOY	Year-on-Year

Chapter 1: Introduction

Transportation plays a significant role in the development of a region as it provides connectivity to all the essential services. There is a lack of research; that is how is the distance of schools/colleges from home is affecting the education accessibility. Also understanding the how public transportation in the bigger picture the work is focused primarily on integrating census, geographical data and bus depot transportation in such a way that street-level bureaucrat and administrators can take better and effective decisions.

The current work is the continuation of the work done by our alumni Mr Sudhuanshu Kulkarni. In which he had built the GIS-based framework for Shahapur Taluka termed as 'Digital geography' for Shahapur Taluka. In this study, we have done an accessibility study of public transport for the education sector. In which we have selected a few schools, based on the walking distance and then we have carried out the fieldwork in those schools.

Scope of the project

The Scope of this report is limited to bus transportation in Shahapur taluka only. In this report, we have only analysed one sector, i.e. education.

Chapter Organisation

This report split into parts/chapters.

Chapter 1 sets the ground of the report by defining our research objectives, research questions and broad societal concern.

Chapter 2. tells about the literature review work done for this project regarding rural public transport and its role in the accessibility of education and health services

Chapter 3 describes the demographics of Shahapur Taluka where the study was conducted along with

Chapter 4 Analysis work done for this project

Chapter 5 tells about how the fieldwork was planned, executed and what results and observations we infer from this fieldwork

Chapter 6 Concluding remark for the project

Broad Societal Concern

Inadequate Public transportation service provisioning in Shahapur Taluka

Research Question(s)

DRQ.1-How rural transportation is affecting education accessibility?

DRQ.2-What transport planning techniques can be used to identify the demand-supply of transportation in Shahapur Taluka for the education sector

Objective

Following are the objectives of the project:

- Evaluating public bus transport planning for Shahapur taluka
- To identify points for social coverage.
- To do social benefits accounting of services offered by Shahapur Taluka Bus depot.

Methodology

The following are the points undertaken:

- From the data available, select the schools which are not following distance norms according to RTE act 2009.
- Visit Shahapur taluka depot and selected schools
- Meeting with the BDO and depot manager
- Surveying selected school students and interviewing principal and teachers
- Analysis of the data collected and infer results from it

Proposed Output

Analyse the data collected from the field and data available and develop an understanding of existing public transport system in taluka is efficiently catering to the education sector or providing adequate accessibility opportunities to the students.

Chapter 2: Literature Review

Rural Public Transport

Public Transport system plays an essential role in social inclusion and in assuring access to services such as work, shopping, education, health, and socio-recreational activities for, all people, including persons with disabilities, low-income persons, older adults and others. Leading indicators which depicts public transport service and also majorly contributes to the people's motivation and ability to use public transport in an area include safety, physical accessibility, cost, journey time and departure frequency.

About 70% of the Indian population is living in the rural region; therefore, transport facilities in rural areas are a must for the wellbeing of rural people as it provides them mobility options which contribute to the faster and overall development of the country. In rural transport, some challenges are that access to public transportation are limited by travel distances and time, frequency, and cost. Also, there is a limitation in funding as well as costs to individuals to tackle these challenges, that is why people prefer to walk as walking for short/long distances, small loads, and steep terrain is cheap and efficient. Also, the lack of public transport in the vicinity create space for other means of transport like minidors, tractors, jeeps, small trucks, auto-rickshaws etc. for covering distances up to 20 km

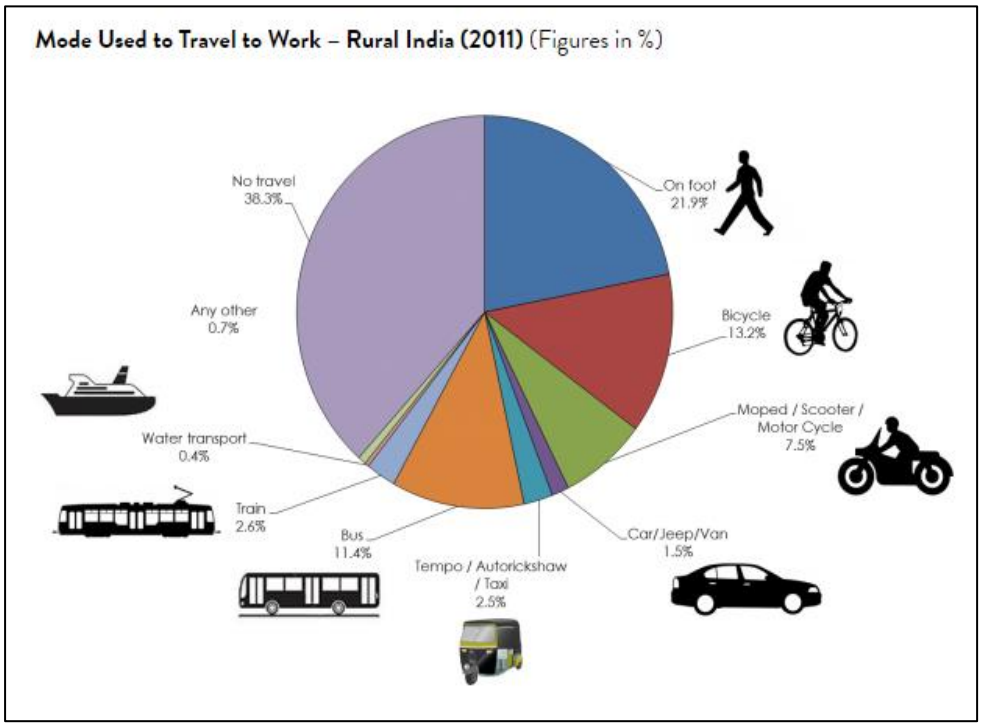


Figure 1: Mobility Patterns in rural India

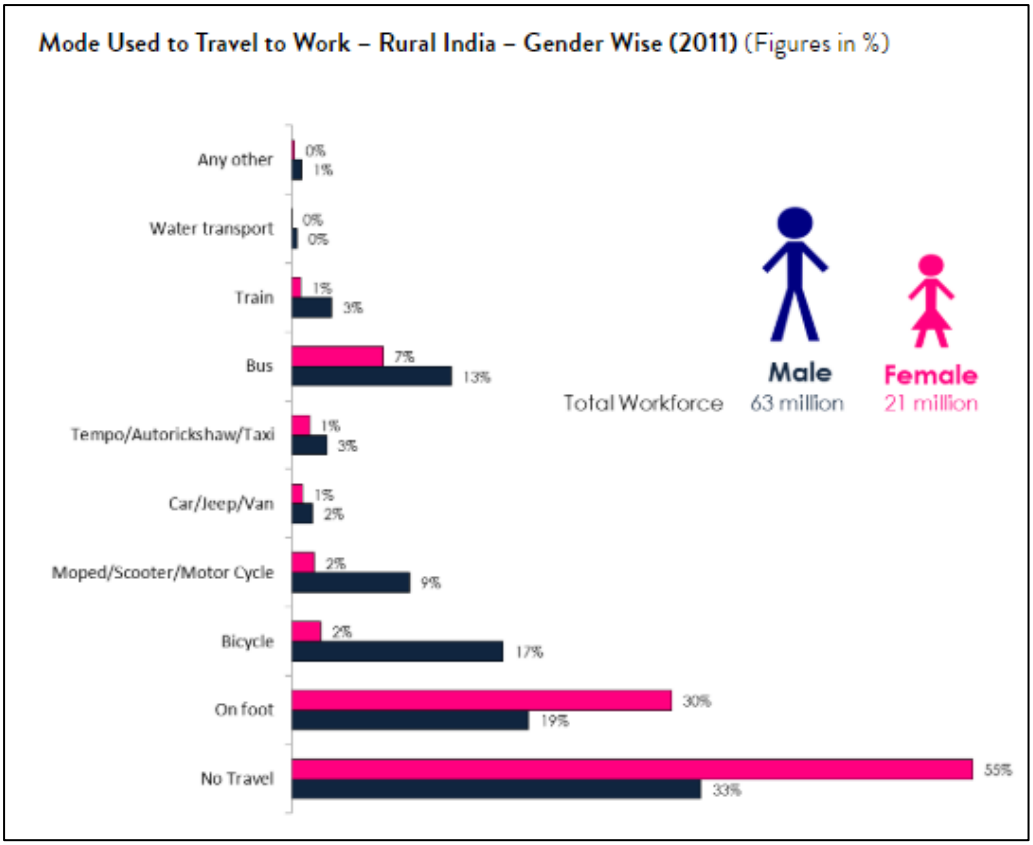


Figure 2: Tranport Mode in rural India

Also according to NSSO 72nd round report, the bus was the most availed mode of travel in a rural area with 50% share of the visitor-trips completed during last 365 days (July 2014-June 2015) whereas in urban area bus (34%) and train (31%) were almost equally used. For the visitor-trips completed during the last 30 days, the bus was the dominant mode of travel - for 70% of visitor-trips from a rural area and 55% of visitor trips from an urban area. This report tries to explore the Rural Transportation Infrastructure management and design in Shahapur Taluka.

SDGs and Rural Public Transport

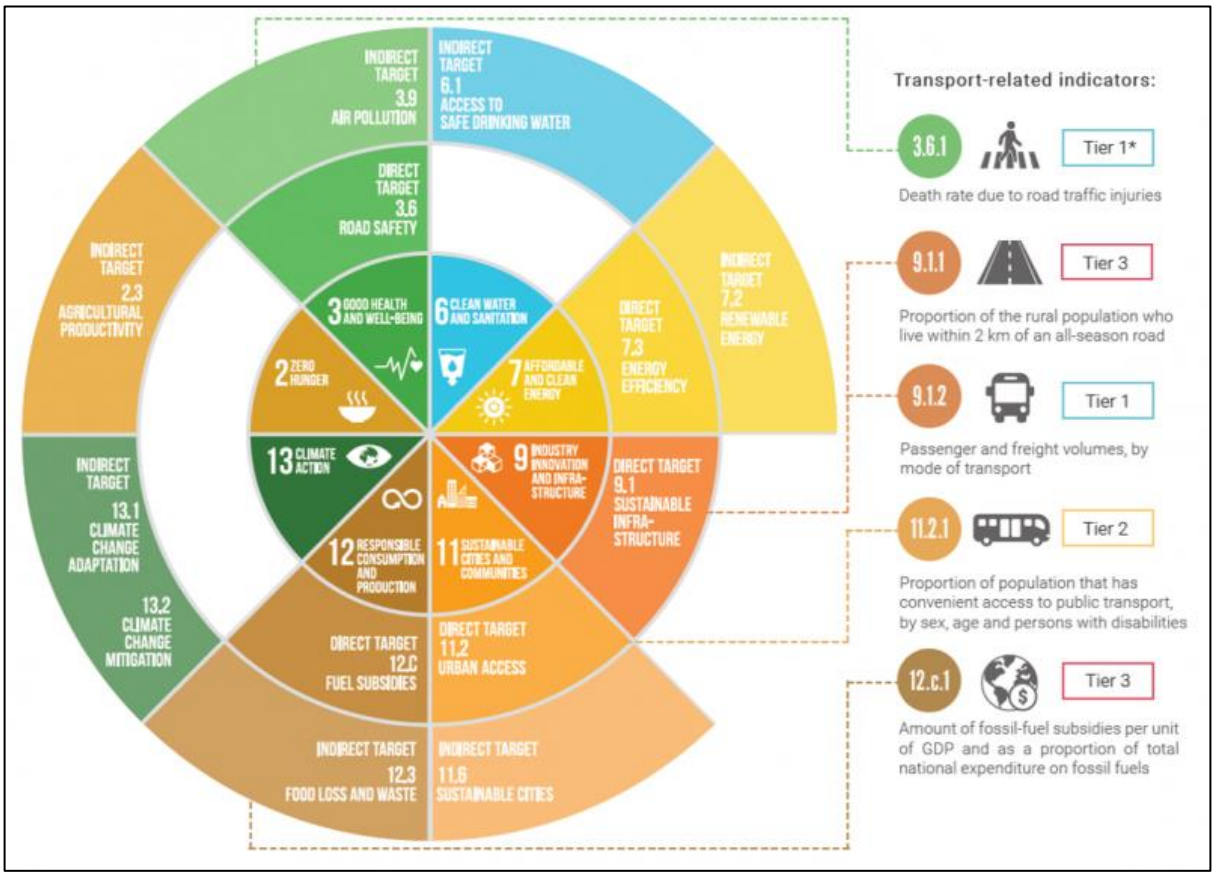


Figure 3: Transport and SDGs

The SDGs or Sustainable development goals which were acquired in September 2015, in this framework the transportation was made as part as it is a crucial contributor to development. In this SDGs, there are 169 targets out of which five can be associated with the transportation sector-

Target 3.6- This states that the number of injuries and global deaths occurring from road traffic accidents should bring down to half of its original numbers by 2020

Target 9.1- To build sustainable, quality, resilient and reliable infrastructure which also include creating a regional and cross-border infrastructure which not only boost economic development and human wellbeing but also it is equally accessible and affordable for all.

Target 11.2- This aim is to make transport system, affordable, sustainable, accessible and safe for all and expanding public transport especially for those who are in vulnerable situations like persons with disabilities, women, older persons and children which also results in enhancing road safety

Target 12.c cut down the inefficient subsidies in fossil fuels that are encouraging wasteful consumption which includes eradicating market distortions which are done according to the national circumstances including phasing out process of those harmful subsidies and restructuring the taxation

Transportation also indirectly affects some of the targets like-

- Agricultural Productivity (Target 2.1)
- Air pollution (Target 3.9)
- Access to safe drinking water (Target 6.1)
- Sustainable cities (Target 11.6)
- Reduction for food loss (Target 12.3)
- Climate Change Adaption and mitigation (Target 13.1)

However, it same paper also claims that providing access to an all-weather road within the radius of 2 Km can also be considered as an indicator for the attainment of the SDGs. "Major Groups" which were identified as the focus of Agenda 21 in the earth summit of 1992 were-

- Women
- Children and Youth
- Indigenous Peoples
- Non-Governmental Organizations
- Local Authorities
- Workers and Trade Unions
- Business and Industry
- Scientific and Technological Community
- Farmers

Rural Transport and Education

Rural Children in developing countries face many hurdles in getting to staying in school, and most of them complete less than four years of elementary education (Vasconcellos, 1997). The relationship of distance and schooling is particularly critical in rural areas, where children must walk long distances to widely dispersed schools and must travel additional distances to nearby urban areas for higher primary grades. Also if there is the unavailability of public transport in the vicinity, then shortage in teachers attendance is also observed as they have to take private

transport for travelling and if a school is very far away from their home than they have to spend more to travel from private transport also there are safety issues associated with them (like overloading by private vehicle owners)

In rural areas, physical location is vital for the level of attendance(Vasconcellos, 1997). A critical issue is that of deciding the best balance between a transportation system that delivers the rural children to urban schools (Vasconcellos, 1997) and another system that runs inside rural areas providing the children to new or adapted rural schools.

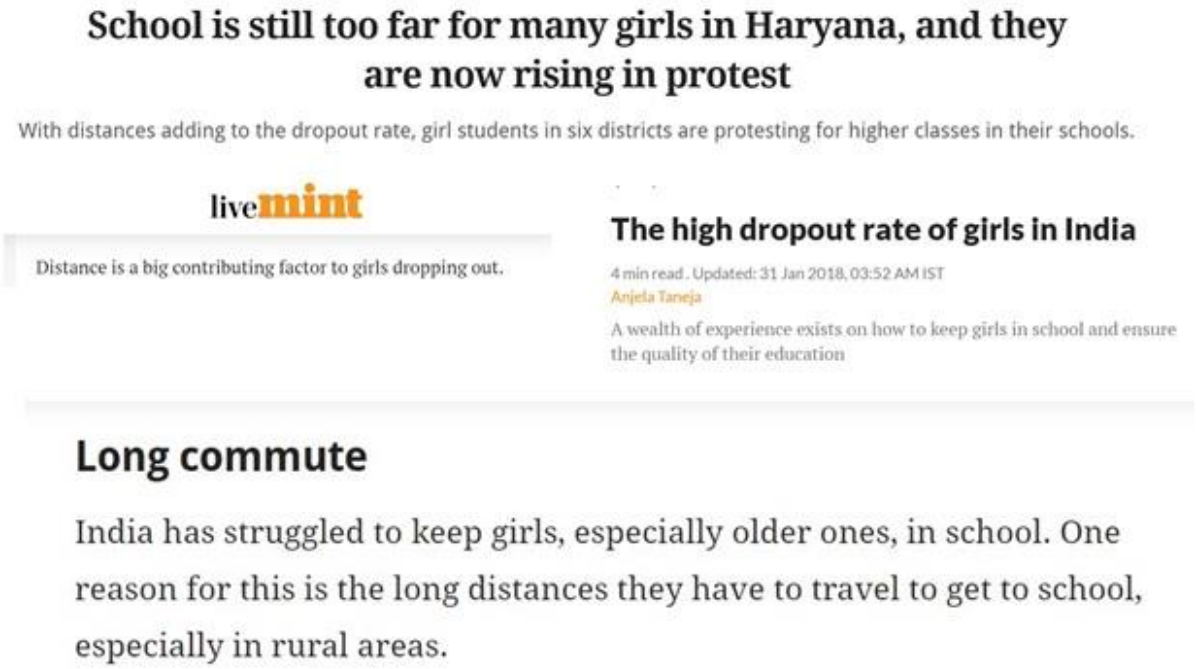


Figure 4: Some newspaper cuttings showing how distance is affecting education accessibility

Also, during monsoon season, when rural roads get damaged and due to lack of public transport in the region, attendance of rural children gets affected, and it also contributes largely to increase in dropout rates.

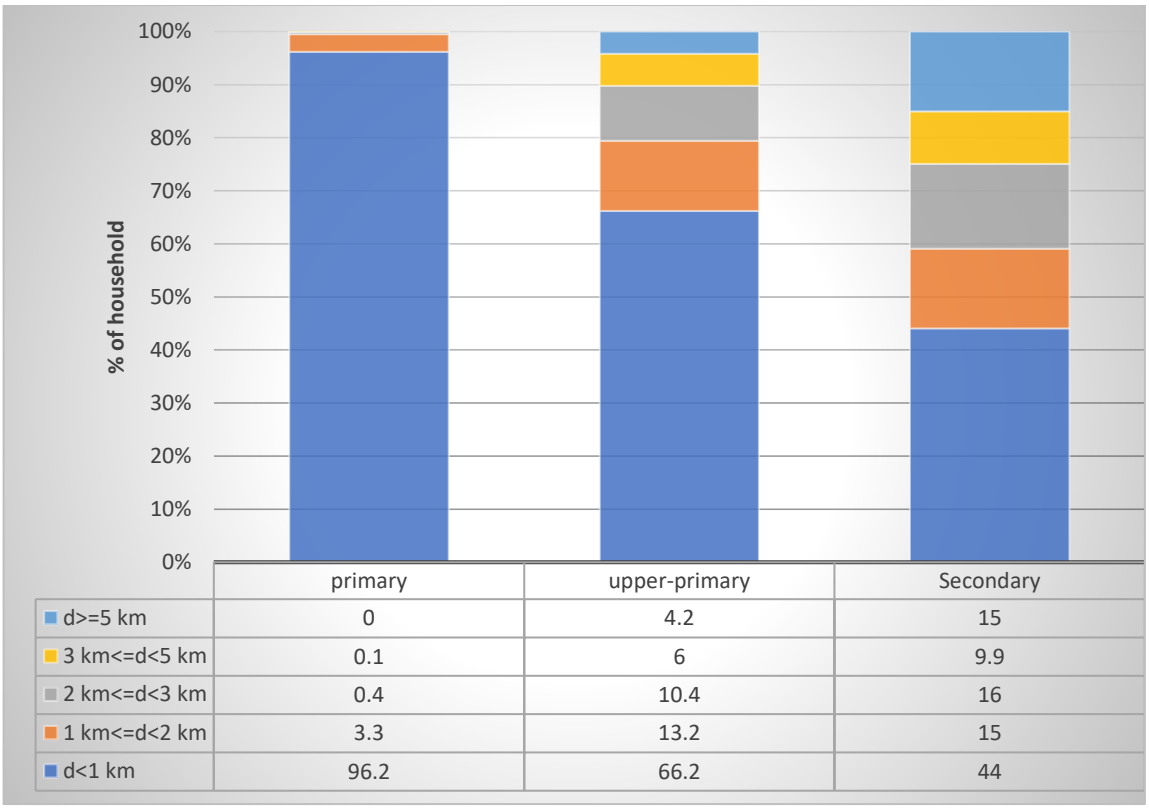
The right to be transported is clearly stated in the law because a school located very far away is not accessible. In Right to Education (RTE) Act defines the limits of neighbourhood schools as 1 km walking distance from the habitation of a child at the primary level (class 1 to 5) and within 3 km walking distance for upper primary level (grade 6 to 8).

Distance to nearest school is the critical parameter which affects the access to education and attendance

According to NSSO 71st survey conducted from January to June 2014 to collect the data regarding Education in India following points have been mentioned about the accessibility of schools from student's residence-

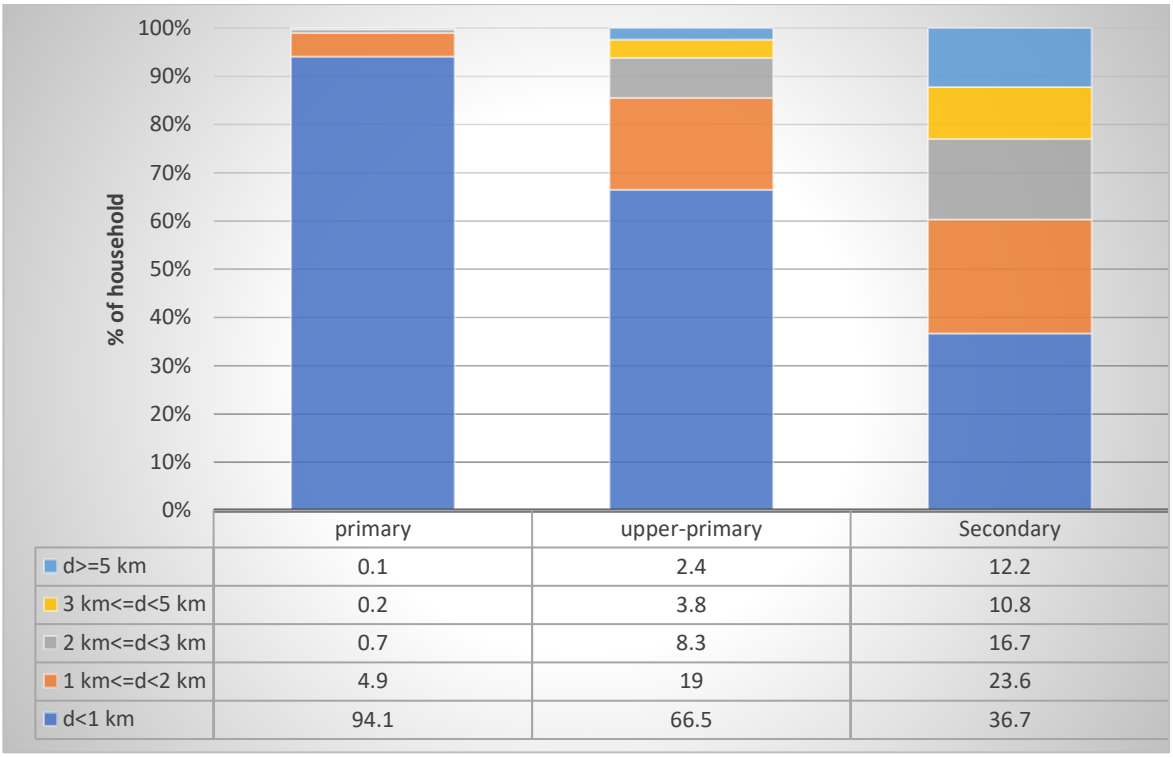
(36479 rural households from 4577 villages and 29447 urban households from 3720 blocks was surveyed all over India.)

- There is no striking difference between the rural Maharashtra and rural part of India in terms of distance exist for physical access to primary schools. Nearly 99% households both in rural and urban India reported that primary schools are available within the 2km radius from the house.
- But when it comes to access to educational institutions which are providing a higher level of education, this gap increases a little bit, approximately 87% of rural households in Maharashtra reported that middle/upper primary schools within the radius of 3 km from their residence compare to 93% of rural households at national level. In contrast, in the case of secondary schools, 85% of rural households in Maharashtra and 88% of urban households reported schools within the radius of 5 km from their residence.



	primary	upper-primary	Secondary
d>=5 km	0	4.2	15
3 km<=d<5 km	0.1	6	9.9
2 km<=d<3 km	0.4	10.4	16
1 km<=d<2 km	3.3	13.2	15
d<1 km	96.2	66.2	44

Figure 5: Per 1000 distribution of households by distance from school for rural Maharashtra (all data in percentage)



	primary	upper-primary	Secondary
d>=5 km	0.1	2.4	12.2
3 km<=d<5 km	0.2	3.8	10.8
2 km<=d<3 km	0.7	8.3	16.7
1 km<=d<2 km	4.9	19	23.6
d<1 km	94.1	66.5	36.7

Figure 6: Per 1000 distribution of households by distance from school for rural India (all data in percentage)

However, according to NSSO 75th round of the Survey, conducted from July 2017-June 2018 to understand the key indicators of household Social Consumption on education in India., there is no such thing mention of accessibility to schools or there is no clear mention of connection between distance and education, but they have mentioned in data that 0.6% males and 3.3% females in rural areas mention the school distance as the reason for enrolling and not attending any schools/institutions, and also 0.6% males and 1.5% females in rural areas mention the same reason for not joining any institution

Also according to Annual Status of Education Report 2017 survey data which includes youth who are 14 to 18 years old. This survey is done by Pratham foundation.

This ASER 2017 survey focuses on 4 points-

- Activity: What is the youth currently doing? Are they enrolled in school or college, working, taking vocational training, preparing for entrance exams? Or some combination of these activities?
- Ability: Can they apply essential reading and arithmetic abilities to everyday situations? Can they do simple financial calculations?

- Awareness and exposure: What do youth report in terms of their exposure to media? Are they familiar with common digital and financial instruments and processes?
- Aspirations: What do youth in this age group report as their educational and career goals?

One major distance related data mentioned in the report is that 11% girls gave the reason related to distance of school from their residence for not attending any institutions

National Education policy

The draft National Education Policy (NEP) 2019), has taken consideration of the high dropout rates and gives many recommendations to decrease it. The report provides several reasons for the high dropout rates, including, poor access, loss of interest in school, inadequate safety, particularly for girls and poor school infrastructure.

The Gross Enrolment Ratio (GER) according to the NEP at the primary level in 2016-17 was 95.1% which was quite high, but it went down to 90.7 % at mid-school level, 79.3 per cent between grades 9-10 and further down to 51.3 per cent at the higher secondary level.

Some of the recommendations given by the policy related to transport to decrease dropout rates are-

- **Making Schools within Reach**-According to the report, in 2016-2017 for every 100 primary schools, there are 50 middle schools (Class 6-8), 20 secondary schools and only nine higher secondary schools. As a corrective measure, the report recommends having more secondary and higher secondary schools, integrating primary and secondary schools in the area to make a composite school, attainable to all.
- **Supporting transport facilities**- ensure safe transport; in rural areas or where the routes to school are not safely or feasibly walkable especially for Children with Special Needs (CWSN)
- **Ensuring security**- Girls' safety outside of school also recognized as critical to their attendance and overall educational attainment. Therefore, proper transportation to and from school should ensure

Maharashtra State Road Transport Corporation (MSRTC)

The Maharashtra State Road Transport Corporation, shortened as (MSRTC, or ST), is the state-run transport administration of Maharashtra, India which serves courses to villages, towns, and urban communities inside Maharashtra just as to its neighbouring states. MSRTC is one of the

largest transport provider organization right now, and 100% nationalization of passenger transport is one of the significant factors behind this extensive growth of MSRTC in the last five decades.(Patil, 2013)

The service approached of the MSRTC is expressed through its slogan stating 'jithe rasta, tithe ST' (where there's a road, there's an ST bus)(Patil, 2013)

MSRTC divided the whole state into divisions, i.e. 1 division in every district and each division has a certain number of deports which are located in talukas. Currently, MSRTC operating 18710 Buses, 609 Bus stands and 250 Bus depots in whole Maharashtra. During the FY 2016-17, MSRTC operated an average 15585 schedules on 18765 routes and carried out 206.61 crores effective Km. operation. Further. The percentage Load Factor, including the value of concession in the FY 2016-17 was 68.75. During the same year, MSRTC was serving 91.64% of villages and was able to serve 96.99% population within a range of 3 Km. During the same FY 2016-17, MSRTC was at Rs. 422 Crore Loss which accounts for about 5.64% of total revenue. MSRTC had 91.98% operations through Ordinary Services. Right now, the corporation is facing stiff competition from private vehicle owners like jeep, autos etc. at taluka level and big private service provider at the state level which are providing services much efficiently due to which the load factor is falling steadily. Also increasing fuel prices, reduction in passengers count and frequent breakdowns adding additional burden on MSRTC revenue. However, efforts are going on to attract passengers to STs.

Chapter 3: Shahapur Taluka

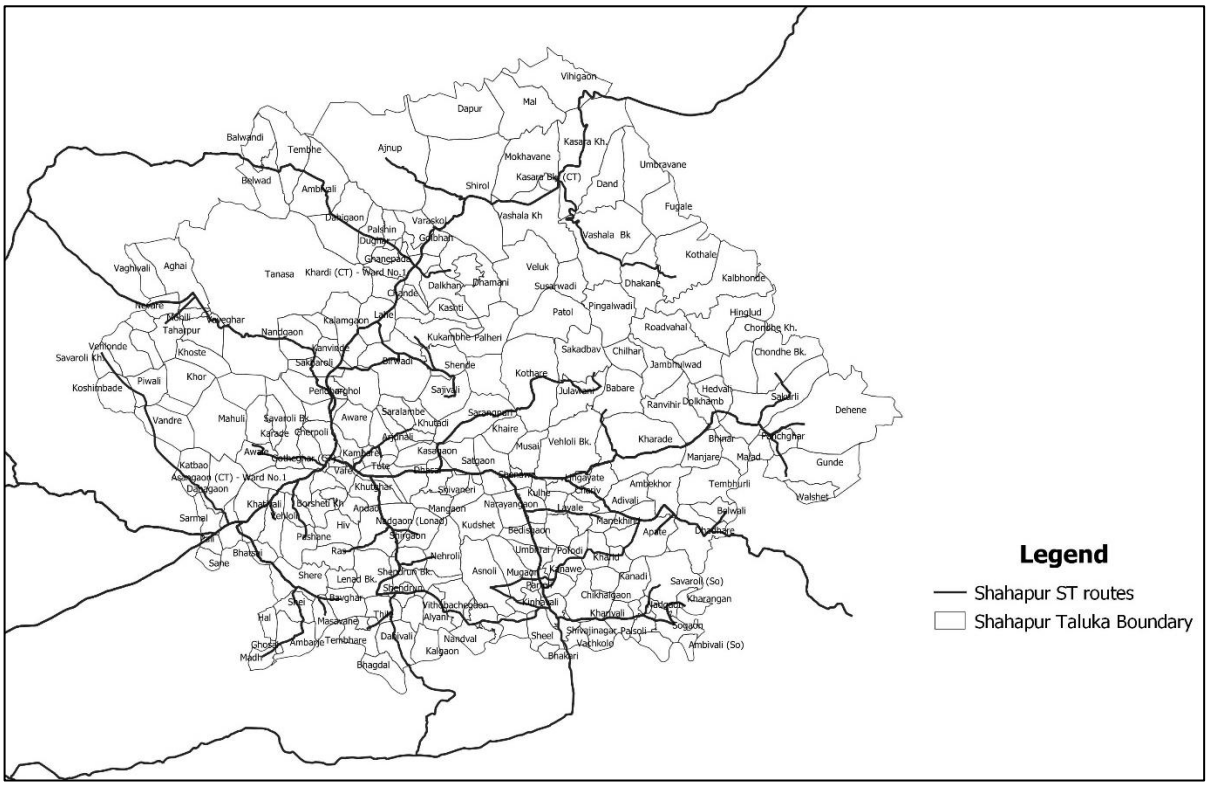


Figure 7: Shahapur Taluka with ST routes

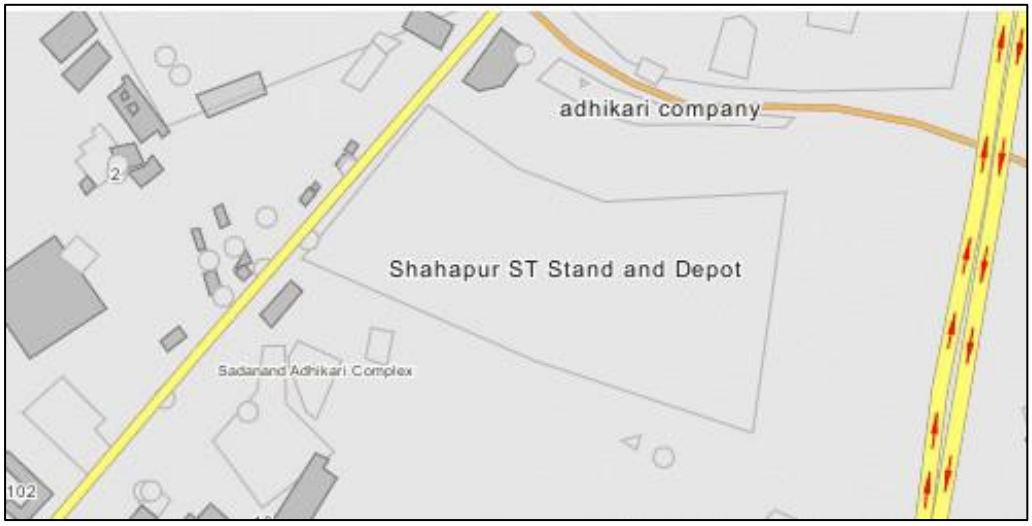


Figure 8: Shahapur Taluka Bus Depot (google street map image)

Thane district comprises of 7 talukas in which Shahapur is one of them. Total of 223 villages were there for which 55 buses. Asangaon is the nearest railway station to the Shahapur bus depot (nearly 2 km away), and it also acts as the source of passengers coming to the depot. Being the rural taluka

Some necessary information about Shahapur are as follows-

District	Thane
No. of Villages	223
No. of Habitations	666(According to NRDWP)
Population	314103(According to Census 2011)
Major Local train stops	Kasara, Asangaon, Vashind, Atgaon, Khardi
No. of Bus routes	266
No. of Buses	56
No. of Buses (operational)	52
No. of Schools	573

Existing Transportation System in Shahapur

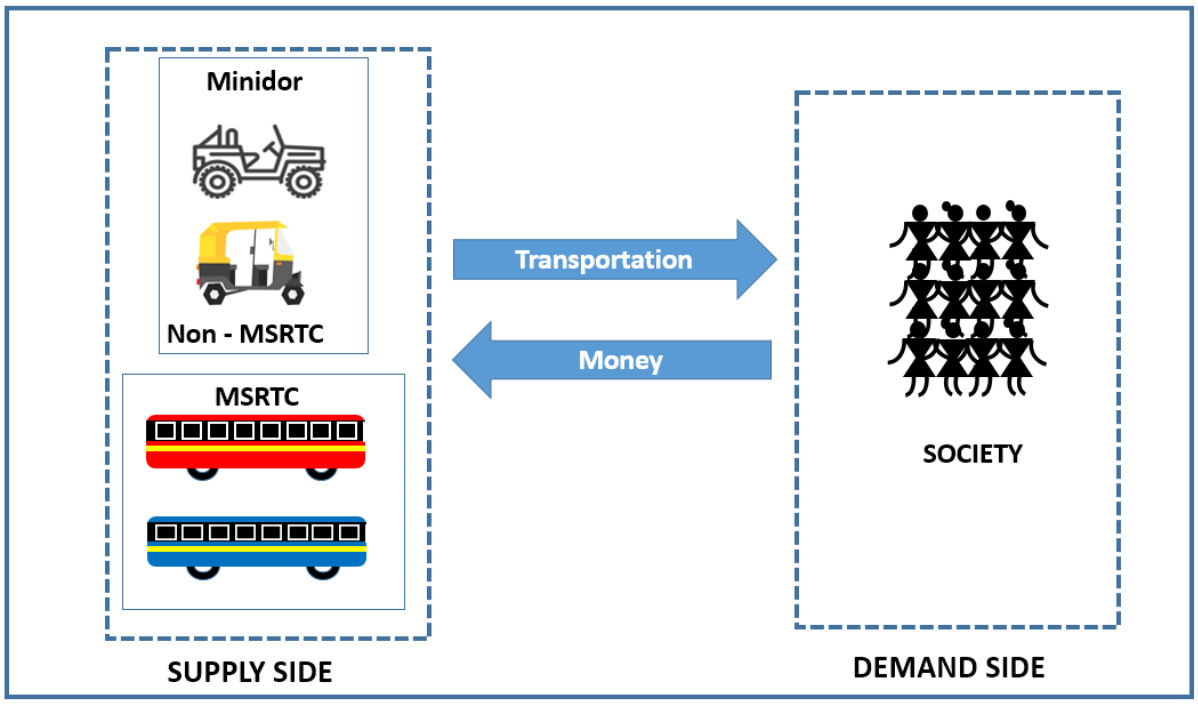


Figure 9: Shahapur taluka transportation system existing system

The following is the existing scenario of service provisioning of transportation in Shahapur Taluka

Public transport Service in Taluka

Implementing the planning approach, public transportation can be simply reduced into demand and supply problem. The demand is created by marketplaces, society, religious activities and so

on. The supply of transport services is provided by various services providers be it MSRTC who are providing transport service namely bus (Manav Vikas and Ordinary) or private service provider or Non- MSRTC service provider who are providing these services by jeeps, auto, minidors and private vehicles.

In case of a private service provider, they run their services om first come and first serve basis, on the other hand, MSRTC follows certain scheduling formats according to which they run their buses. This format is Form4, which is prepared by the division office by taking the help taluka's Depot Manager. It can be updated on request in 6 months. Apart from this, they also make ABC data which consists of tray earnings of MSRTC.

Manav-Vikas Buses

This is a part of Manav-Vikas Scheme which is an initiative of the Government of Maharashtra to increase Human Development Index of backward districts of Maharashtra, India. The programme was launched in 2006. Currently 125 tehsils/blocks from 23 districts come under this mission. The initiative focuses mainly on the health, income generation and education of populations in rural areas.

Manav-Vikas bus service was started by state government in June 2012 after observing that village girls abandon their educations midway because of the lengthy distance between high schools and villages. This was started to provide free bus transport accessibility to transport girls in rural areas so that they can attain education up to 12^{th} standard. Since in this project, we are working for MSRTC service provision for the education sector and Manav-Vikas Services are started by the Government to cater to the education sector only therefore we are focusing on this service also. Its main focus is on human development of the area not on profit-making; therefore, these services are subsidized by the ministry. These buses are started based on SC-ST% population in a village-based on Census data and also on the request of school authorities in panchayat Samiti meeting.

Non-MSRTC/Private Operators

Jeeps, minidors and autos are present there as an alternative to Government bus services. Generally, Jeeps ply to a distance of 10-15 km from Shahapur bus depot to Aghai, Bhatasa, Khardi, Sarlambe, Hiv, Lenad, Shenave, Kinhavali, Dolkhamb, Sakalbav, Kothera, Gegaon and Murbad via Lenad Route. They charge Rs 30-40 per seat.

Shahapur Schools

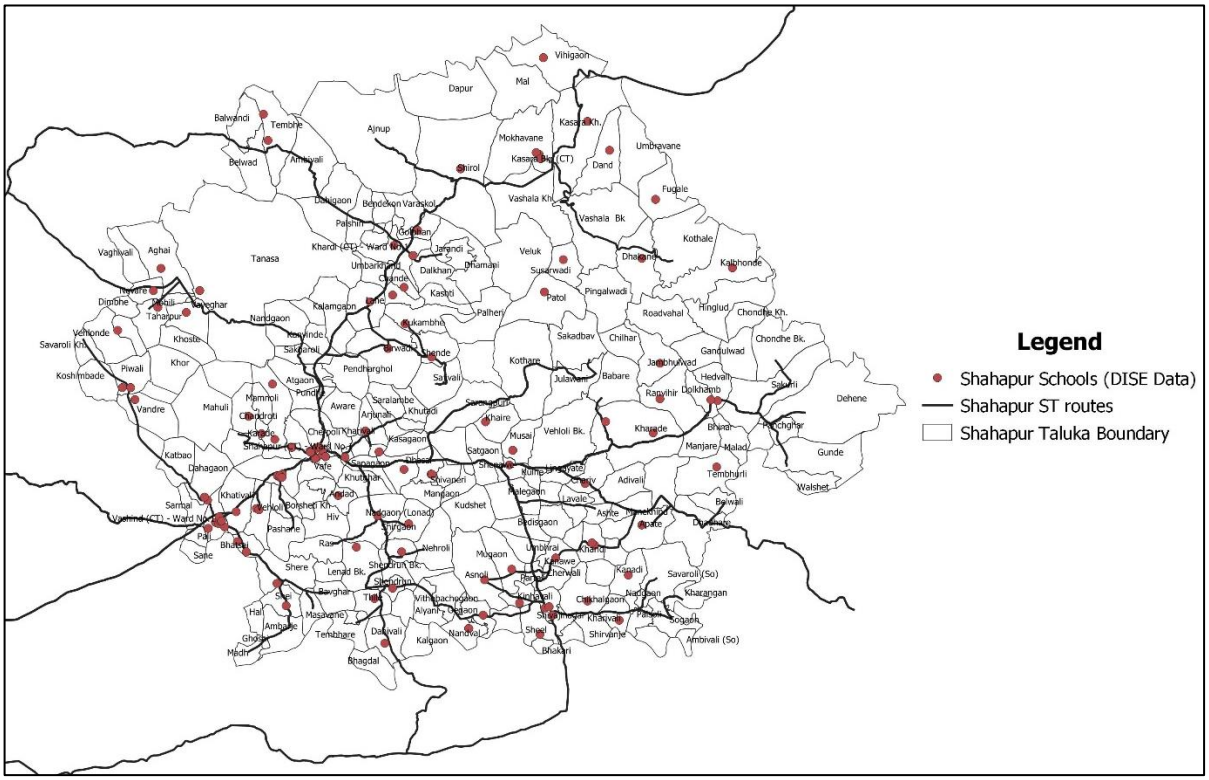


Figure 10: Shahapur Taluka all School Locations with ST routes

Shahapur Schools in Numbers –

Total No. of Schools	573
Primary Schools	538
Middle/Upper primary schools	214
Secondary Schools	86
Senior Secondary/ Higher Secondary/ Pre-university education/Junior college	25

Table 1: Category wise Schools in Shahapur Taluka

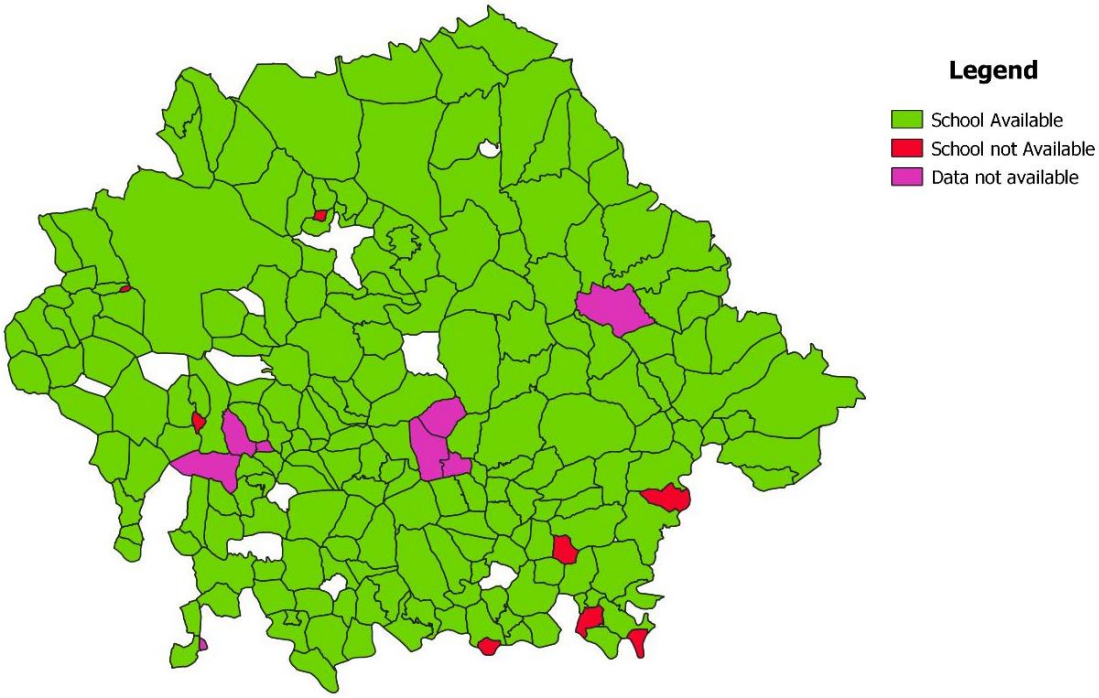


Figure 11: Primary government schools in Shahpur taluka (Census 2011 data)

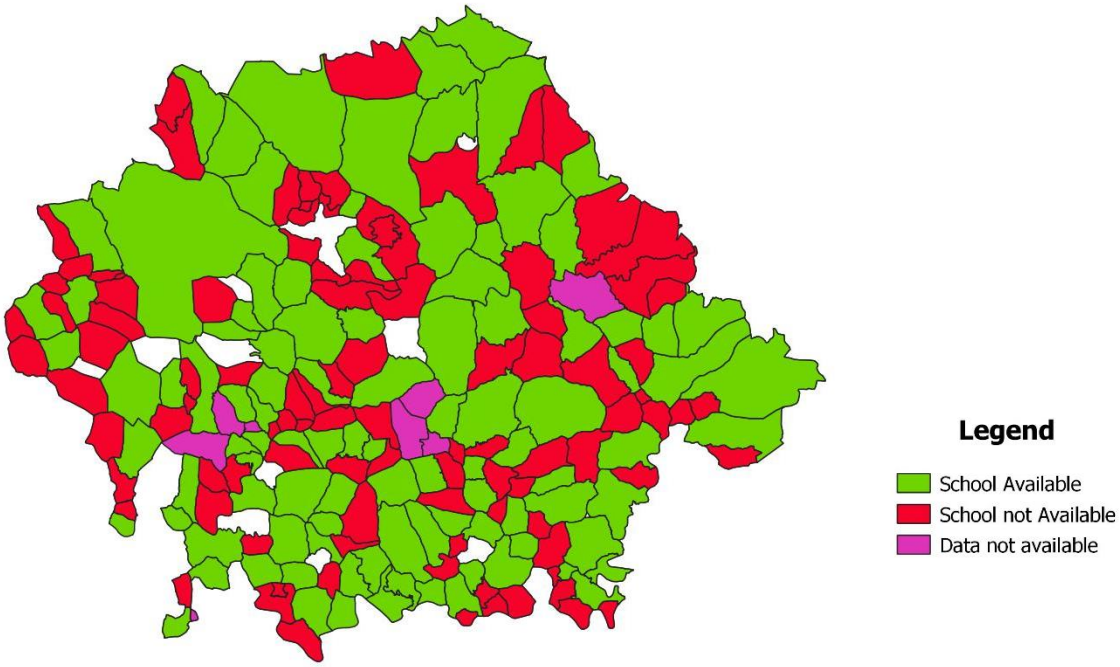


Figure 12: Upper-primary/middle government schools in Shahpur taluka (Census 2011 data)

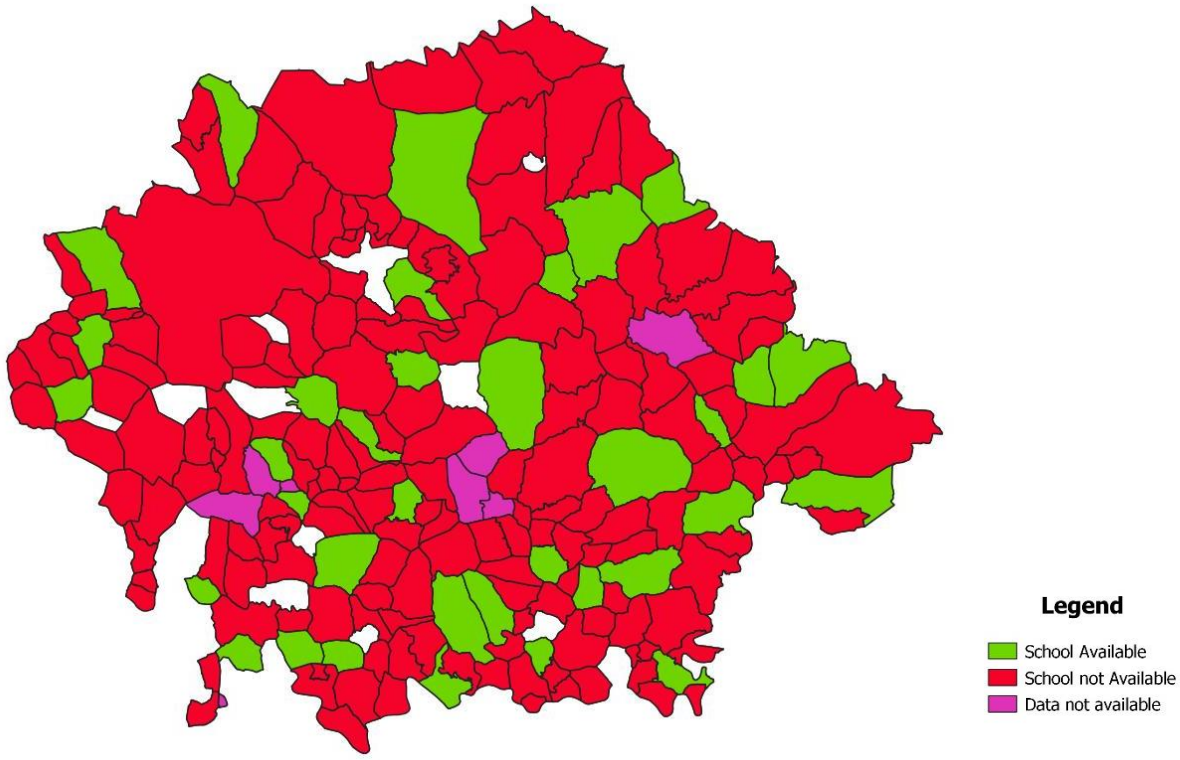


Figure 13: Secondary government schools in Shahpur taluka (Census 2011 data)

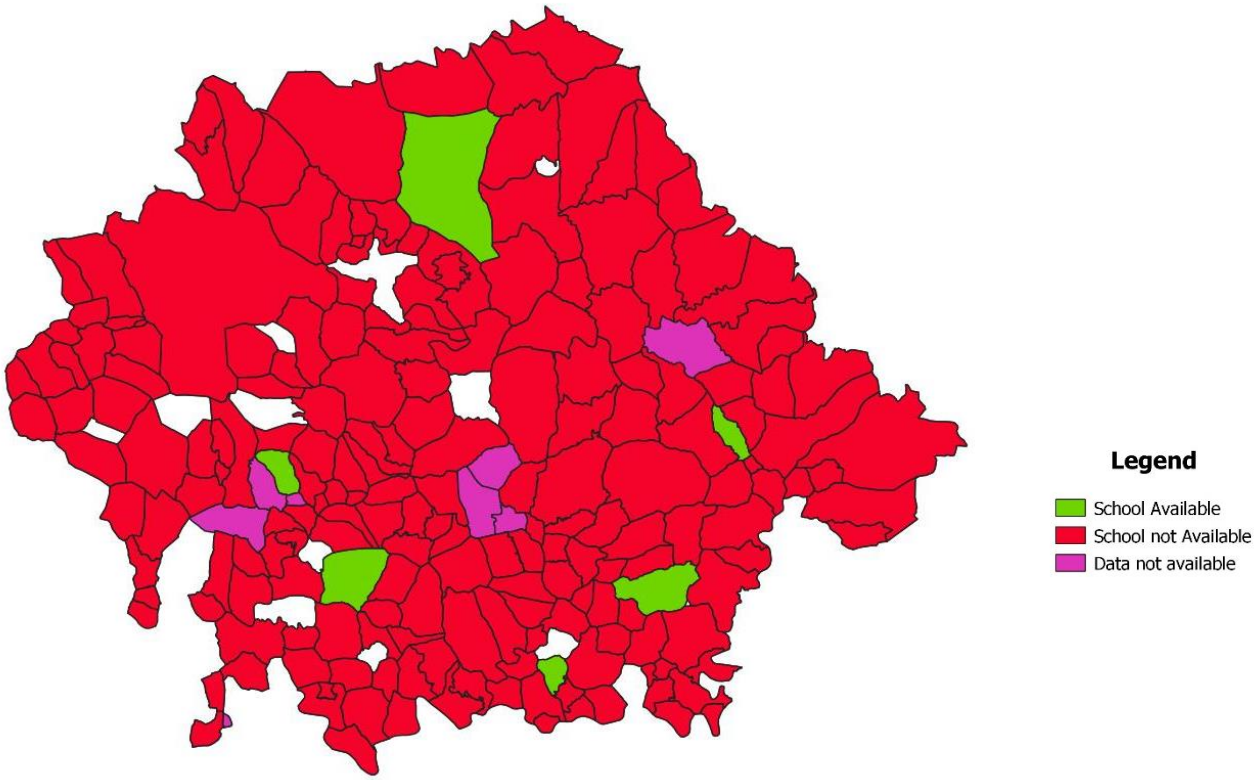


Figure 14: Senior secondary government schools in Shahpur taluka (Census 2011 data)

Existing Situations

Problem 1- Manav Vikas service is there in Taluka but either it is not accessible by all students or it not present.

Problem 2- MSRTC losing its passengers to Non-MSRTC operators due to its absence in some areas or its inefficiency

Some Basic Definitions

Accessibility

In the transport context, accessibility can define as facility or opportunities with which essential services can reach from a given location by using a particular transport system

Neighbourhood School

Right to education act which came into effect in the year 2009 states this term, which means the distance of the nearest school from child's residence. The Neighbourhood Concept states that the school should be available within a safe and accessible distance from the child's habitation. Limits of walking distance for neighbourhood schools defined by this Act is 1 km for primary School (Class 1st to 5th), 3 km for middle schools (class 6th to 8th) and.5km for Secondary Schools (Class 9^{th} and 10^{th})

However, these distance rules are according to the terrain of the place. The Government is made responsible for ensuring the availability of these neighbourhood schools.

As per data given by States/UTs, 971.15% of habitations covered by primary schools, 96.49% of dwellings covered by middle schools and 88.24% habitations covered by Secondary schools. The areas which were left are mostly small village/habitation or sparsely populated area in steep terrain where it is not feasible to open a school either residential schools and hostels and provide transport and escort facility to students to reach these schools. (*11 JUL 2019 4:40pm by PIB Delhi*)

Bad Schools

We coined this term for some selected schools. According to this term if the walking distance from the nearest school to the village centroid is more than the distance prescribed in the Right to Education act for neighbourhood school than we termed this village as a problem village. The school where these students are studying are called as **Bad schools**. In our analysis route length

left after reducing ST route length from total route length or shortest route length from village centroid to nearest school/neighbourhood school, is considered as walking distance.

Catchment Area

Catchment area is the geographical area from which an institution, service and city attracts population that uses its services. For example, a school catchment area is the geographic area from which students are eligible to attend a local school.

In this project we have measured catchment area based on spatial accessibility of a service by using distance to nearest provider. It is typically measured from an individual residence or from a population centre. Travel impedance, sometimes referred to as travel cost, is often measured in units of Euclidean (straight line) distance, travel distance along a road, or via a transportation network. Travel impedance to nearest provider has been assumed to be a good measure of spatial accessibility for rural areas. Regardless of suitability for rural areas, this measure is probably not suitable for urban settings because it is insensitive to the fact that in congested areas there is usually an array of provider options at similar distance from any reference point.

We have used Geographic Information Systems in determining catchment area and travel impedance for each school (category-wise) by integrating following GIS datasets

- ST routes or road network
- Location of schools
- Shahapur taluka polygon containing CensusGIS data attributes

From the analysis we are assuming that student population fall under particular school catchment area are going to that school only as it is the nearest facility (less time taking) for them if they travel either through ST route network or road network.

However, in the absence of road or route segment data we will measure the school catchment area by displacement method i.e. shortest distance between village centroid and school location though it is not a very good way of measuring catchment area as some area of this taluka has hilly terrain which makes it impossible for anyone to move through that shortest path or distance.

Chapter 4: Analysis Work

Secondary Data Used

- **Shahapur PHC and Sub-PHC:** Latitudes and Longitudes data of these centres taken from Maharashtra Aarogya website (as of 1 April 2020)
- Shahapur Road Network GIS data was in the shapefile (.shp) format (Data source: MRSAC)

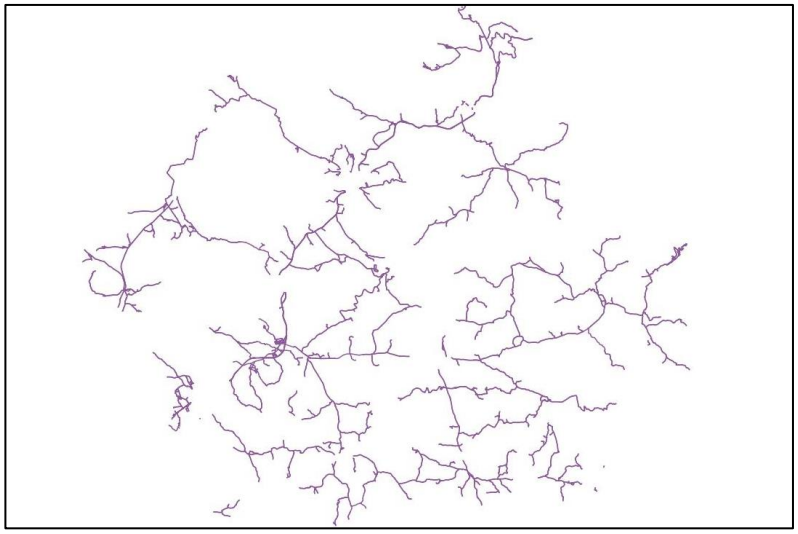


Figure 15: Shahapur road network

- **Shahapur ST Route Segment:** This data created by using the shortest path algorithm via the road network. This data contains GIS data of the route segment of all the Shahapur routes in shapefile format. A ST bus route is a path covered by a bus from one place to another where a bus travels regularly and a route segment is a path or part of the bus route between consecutive bus stops of a Bus Route.

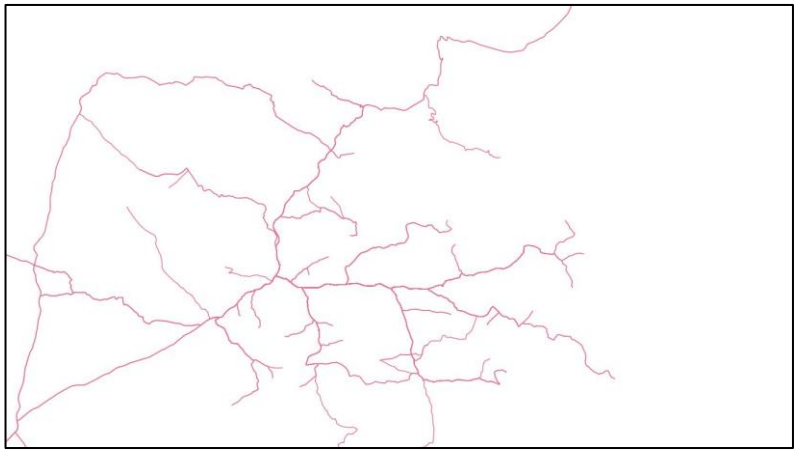


Figure 16: Shahapur ST route network

- **Shahapur School Data:** This data has been scrapped from SchoolGIS website; it only contains school code, elevation, taluka name and school latitude and longitude. Later for knowing school category and school village location, we merged this data with DISE data which taken from schoolreportcards website. Other than this data This schoolreportcards website contains the data like Enrolment numbers in school caste-wise and gender-wise (General, SC, ST and Girls), school location, School management type, School category and other facilities present in school premises etc.

  We have utilised these enrolment number data to find out the percentage of population (Open, SC and ST) falling in the catchment area of a school served by a that particular school.
- **Polygon file of Shahapur with Census GIS attributes:** following types of data attributes from CensusGIS we have used for our computation:
  - Geometry attribute, taluka name, area/village name
  - Population data attribute: CensusGIS data contains caste-wise (SC and ST), gender wise (male and female) population data at village level

  Also, it contains other type of data attribute such as-

  - Amenities present in village-like Banking facility, Education facility, healthcare Facilities etc.
  - Household data like source of lighting, source of drinking water, availing bank facilities, type of structure of census houses etc.
- **Habitation Data:** This data we have scrapped from NRDWP site. This data only contains village wise habitations names and population in these habitations (not coordinates of these habitations).
- **ETIM Data:** It stands for the ticket data issued by ETIM (Electronic Tickets Issuing Machine) for the bus service provided by MSRTC. TRIMAX company stores this data. We have ETIM data of July month
- **ABC data:** We have ABC analysis data of July 2019 for Shahapur. MSRTC provides this data
- **Form 4:** This data contains Schedules of Thane bus trip taluka wise
- **Master File:** This contains the route sequences of all routes of Thane

Schema

Here Schema refers to attributes in the data:

Route Segment

Field Name	Field Type	Description
route segment id	character varying(30)	Unique id of Route-segment
geom	geometry(LineString,4326)	Polyline geometry of the route segment

Table 2: Schema of route segment

Form 4

Fields	Type	Description
scheduleid	numeric(30, 0)	Unique id of schedule
dutyid	character varying(50)	Unique id of crew duty
serviceid	character varying(50)	Unique id of Bus service
source eng	character varying	Name of source village
source mar	character varying	Name of source village in marathi
destination eng	character varying	Name of Destination village
destination mar	character varying	Name of Destination village in marathi
arrival	timestamp(6) without time zone	Arrival time
depart	timestamp(6) without time zone	Departure time
distance	numeric(10, 0)	Distance between the two termini
route segment	character varying(50)	Unique Route segment Id

Table 3: Schema of Form4

ABC data

Field Name	Field Type	Description
gid	Integer NOT NULL	Primary key
Route_no	Integer	Route number

origin	character varying(254)	Source bus stop code of route segment involved in between of trip
destinatio	character varying(254)	destination bus stop code of route segment involved in between of trip
Sr no	Bigint	Serial number
trip_numbe	character varying(254)	Trip Number
route_name	character varying(254)	Route name
from	character varying(254)	Initial Source Bus Stop Name of trip
from_code	character varying(254)	Initial Source Bus Stop Code of trip
to	character varying(254)	Final Destination Bus Stop Name of trip
to_code	character varying(254)	Final Destination Bus Stop Code of route segment between the trip
bus servic	character varying(254)	Bus service type
Dept time	Numeric	Departure time
kilomete	Numeric	length of trip
fare	Bigint	fare
Oper trip	Bigint	
Operated k	Numeric	Operating Km
Psgrs earn	Bigint	Passengers earning
Other earn	Bigint	Other earning

Total earn	Bigint	Total earning of trip
Net earnin	Bigint	Net earnings of trip
Expt earni	Bigint	Expected earning of trip
% load fa	Numeric	Load factor of bus trip in percentage
Net epkm	Numeric	Net earnings per kilometer
abc_status	character varying (254)	ABC status of the bus trip
no of psgr	Bigint	Number of passengers traveled in trip

Table 4: Schema of ABC data

Master File

This table contains the Thane Routes sequences file as received by MSRTC

Field Name	**Field Type**	**Description**
Route_auto	Integer	
Route_no	Integer	Route number of the route
BUS_STOP_CD	character varying(254)	Bus stop code of the bus stop
BUS_STOP_NM	character varying(254)	Bus stop name of the bus stop
STOP_SEQ	Integer	Bus stop sequence number of respective route number
SUB_STAGE	character varying(254)	
KM	Numeric	Distance of bus stop from the route starting point in kilometer
INTRA_STATE_DISTANCE	Numeric	
INTER_STATE_DISTANCE	Numeric	
STAGE_NO	Integer	

Table 5: Schema of Master File

Methodology

- We have Shahapur Village polygons data; by using **Geometry Tools** of QGIS, we have taken out centroid of these villages/polygons. Due to lack of habitations coordinates (Even though we know the habitation-wise population), the village population considered to concentrated on the centroid of the village.
- Then we have built the **Projections,** i.e., created **Perpendicular** from village centroid and school to the nearest point of Shahapur ST route and considered this as the closest bus stops for both schools and village centroid. We are assuming that these students are walking this distance (i.e., projections length) to catch the bus.
- Then by using **Hub and Spoke concept,** we have built the **Origin-Destination Matrix** in which we have calculated the shortest path between a set of origin points and another set of destination points. This analysis tells us the nearest facility (in our case schools) to any given point (i.e., village centroid) and also tells us travel distance between them by taking a length of the road network (in our case projections and Shahapur ST route). Here we have use **QGIS Network Analysis Toolbox (QNEAT3)** plugin, which based on the Distance matrix algorithm in which we have to find out the nearest school to each village centroid.
- By this analysis, we get that some schools do not get any villages like shown in fig 16.And this might be possible that some villages are nearby to some specific category of colleges (might be primary or middle schools or secondary school) which is not feasible for our study as we cannot calculate the distance travelled by a student or increase in distance for the students for a particular village as he/she promoted to a higher standard. So, this defies our analysis

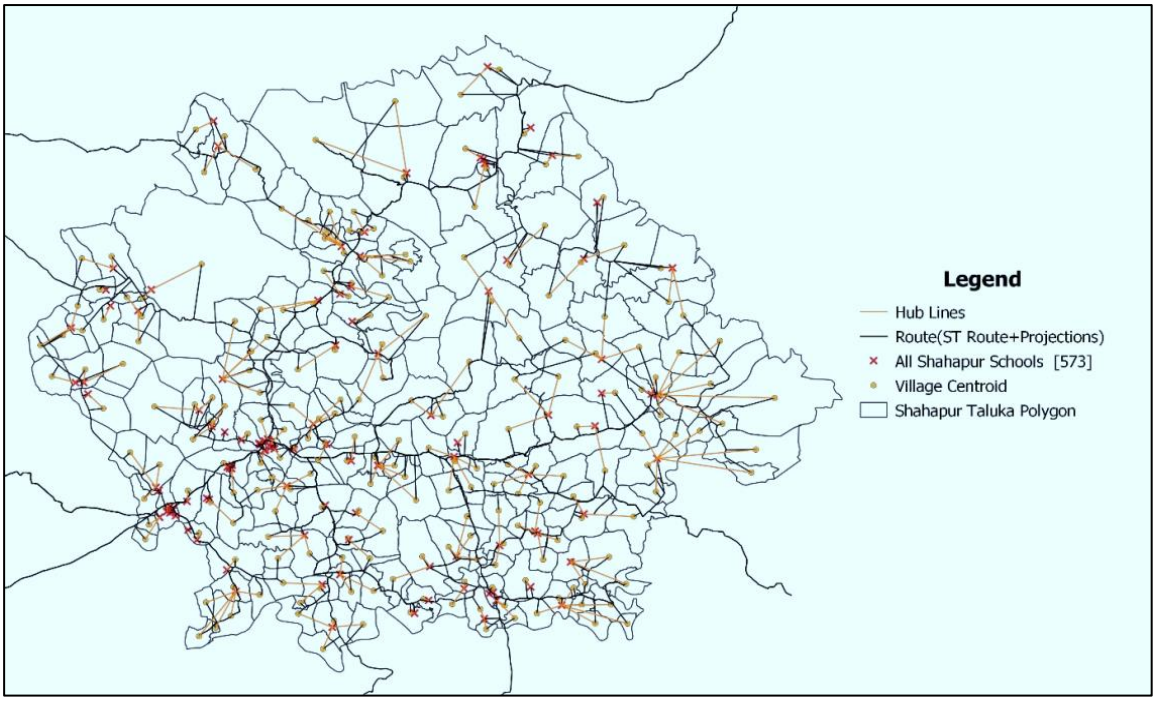


Figure 17: Mapping of all School with nearby villages

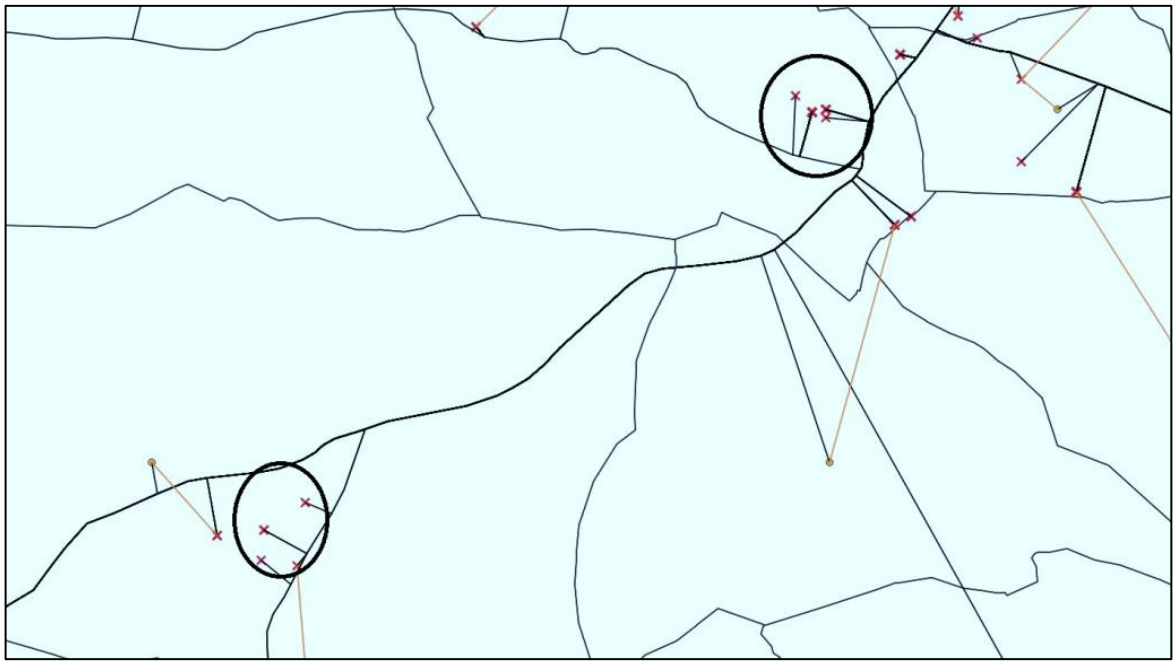


Figure 18: Schools which do not get any village

- For a better understanding of the increase in distance, we have classified school's data into Primary School, Middle School, Senior Schools, and Senior Secondary with the help of **Query Builder** in QGIS for better analysis.
- Origin-Destinations pairs have been formed for village centroids and their nearest schools of each category based on **Hub and Spoke model.**

- After that, we have calculated the distance between villages centroids and schools by using the **Dijkstra Algorithm** considering both projections (i.e., Projections from village centroid and schools to nearest ST road network point) and Shahapur ST route. After that, hub lines were created to show the nearest school for each village.

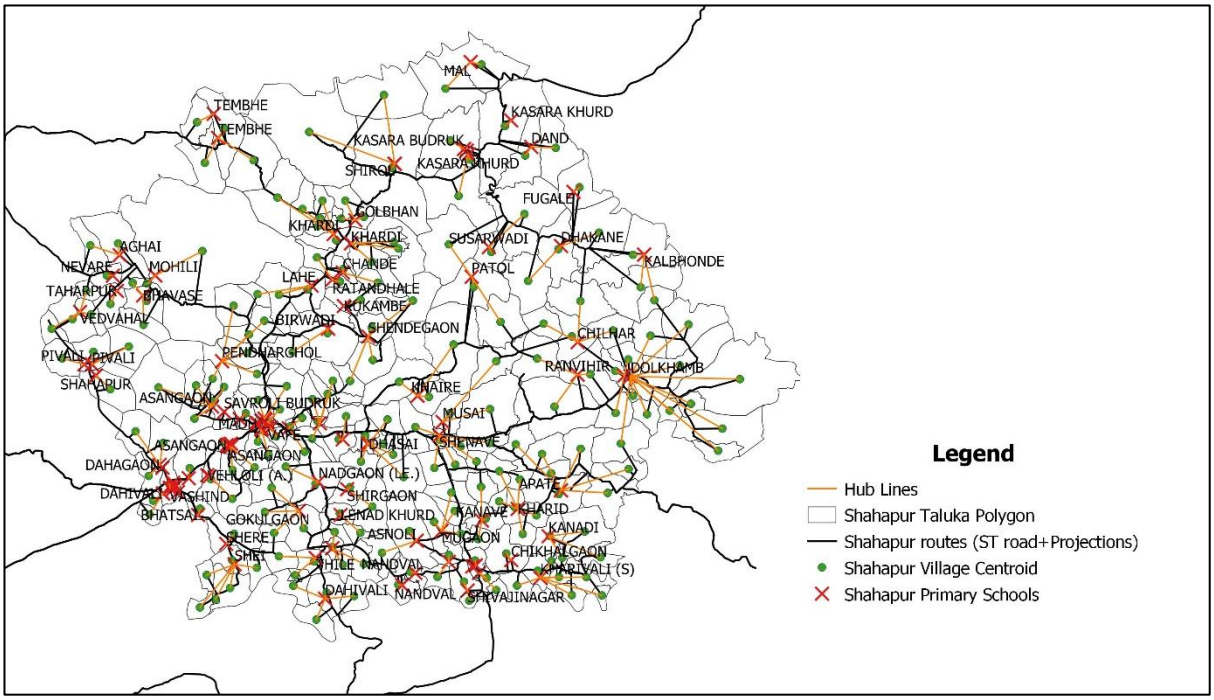


Figure 19: Mapping of Primary School with nearby villages

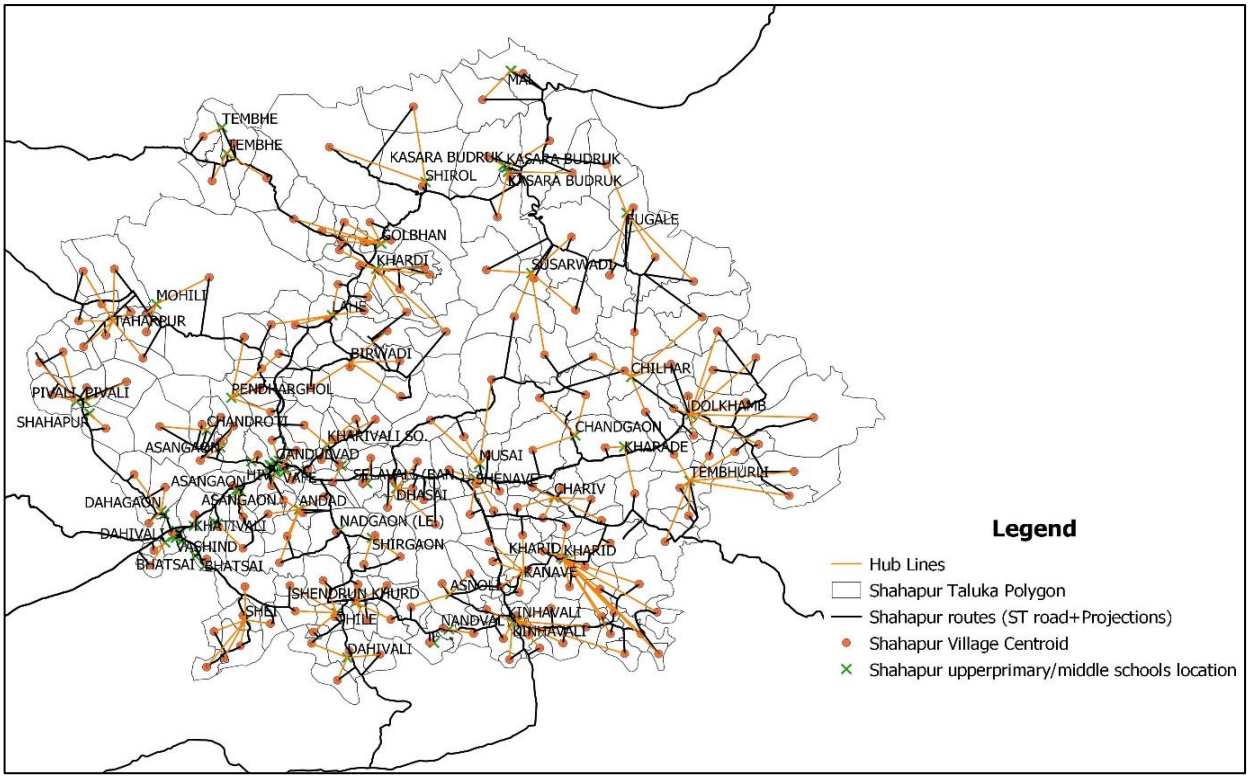


Figure 20: Mapping of Upper Primary School with nearby villages

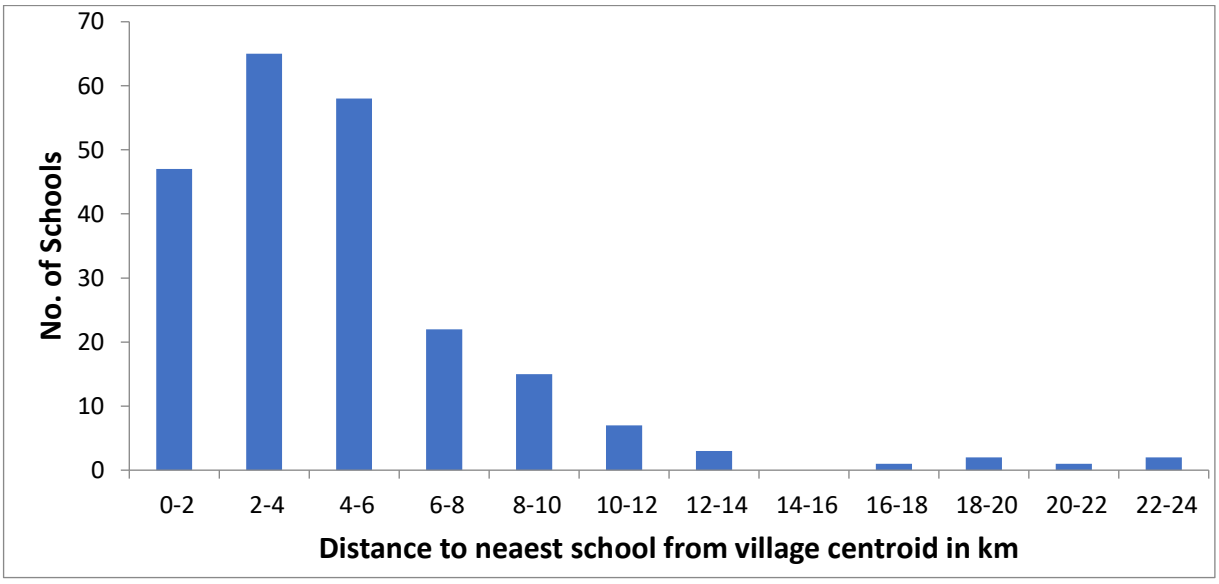


Figure 21: Frequency distribution of upper-primary/middle schools in Shahapur distance wise

Mean	4.75
Median	4.00
Standard Deviation	3.80
Standard Error	0.25

Table 6: Basic statistics about upper-primary/middle schools in Shahapur (According to distance (in km) to nearest school from village centroid)

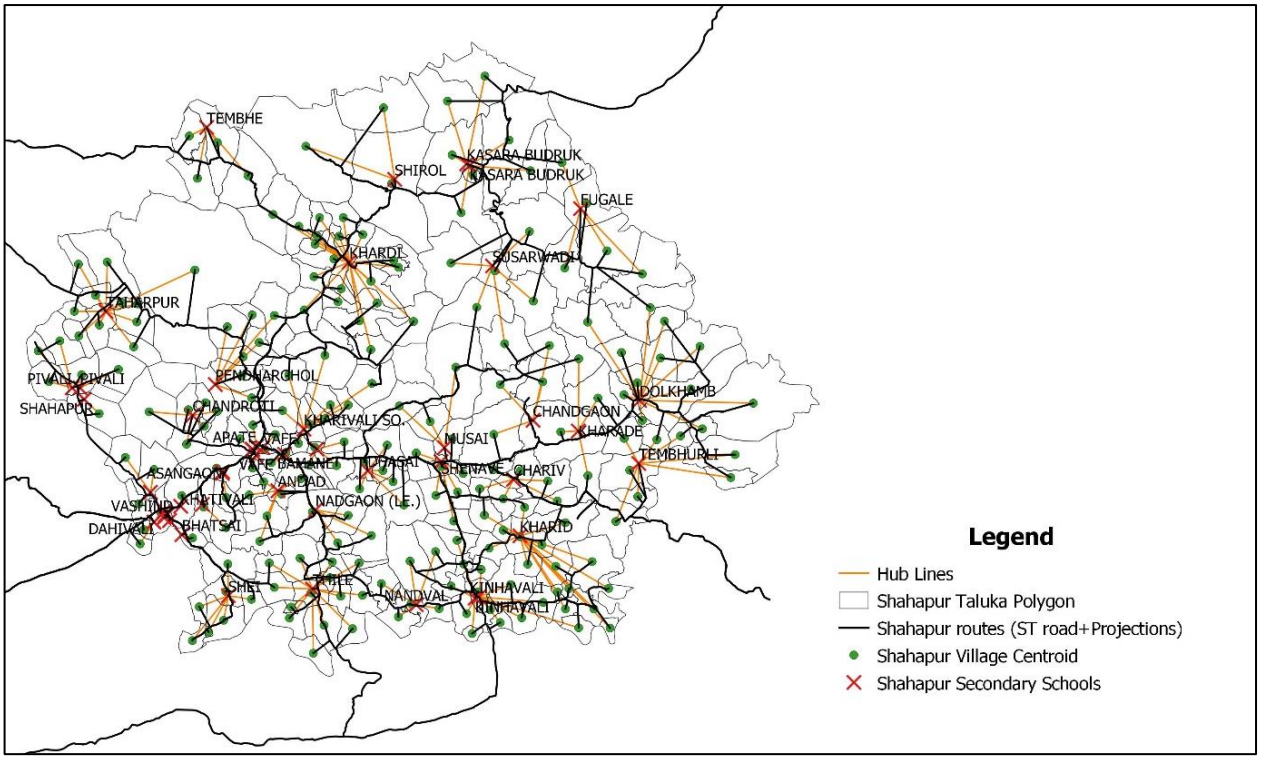


Figure 22: Mapping of Secondary School with nearby villages

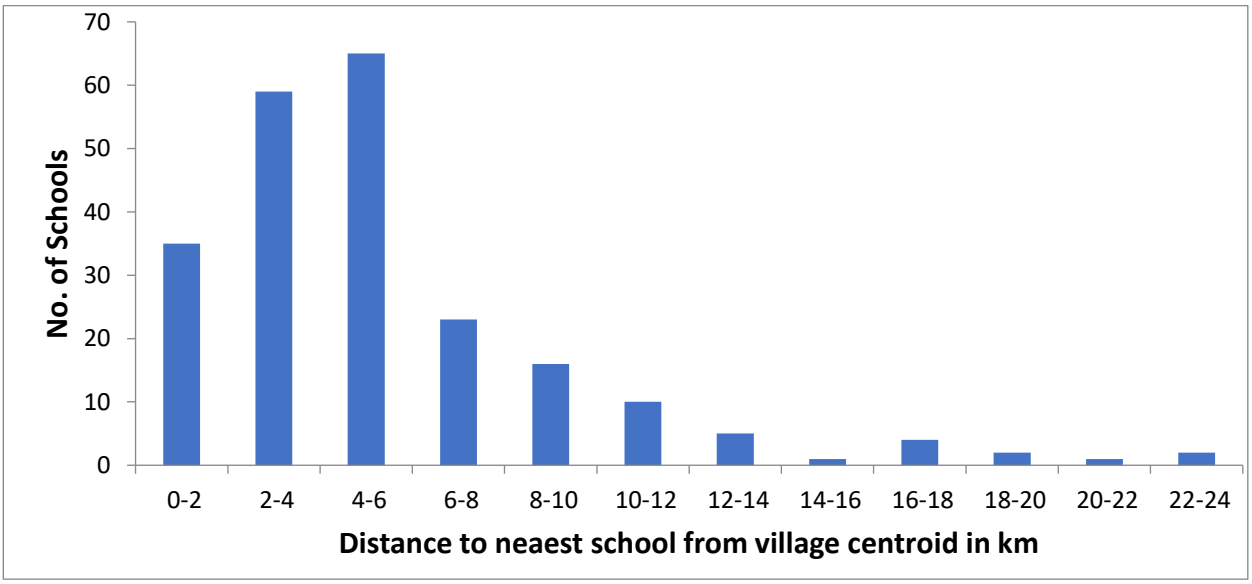


Figure 23: Frequency distribution of secondary schools in Shahapur distance wise

Mean	5.47
Median	4.51
Standard Deviation	4.10
Standard Error	0.27

Table 7: Basic statistics about secondary schools in Shahapur (According to distance (in km) to nearest school from village centroid)

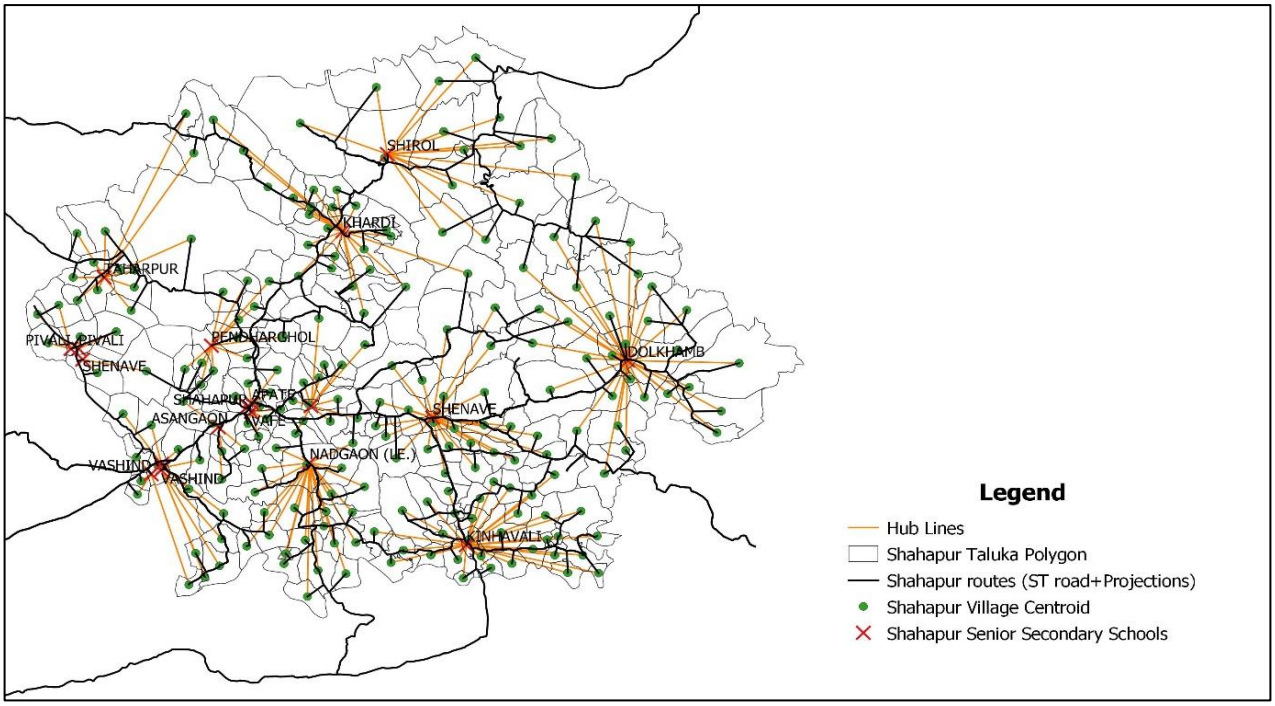


Figure 24: Mapping of Senior Secondary School with nearby villages

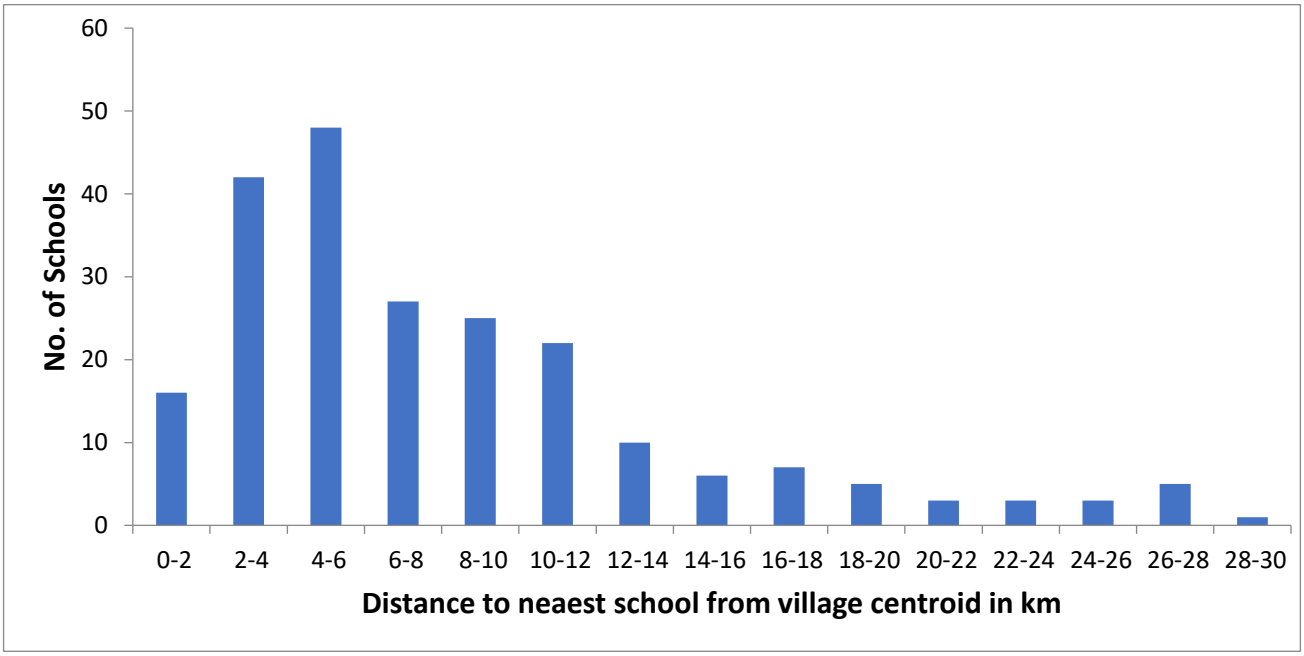


Figure 25: Frequency distribution of senior secondary schools in Shahapur distance wise

Mean	8.33
Median	6.49
Standard Deviation	6.16
Standard Error	0.41

Table 8: Basic statistics about senior secondary schools in Shahapur (According to distance (in km) to nearest school from village centroid)

- The following figure helps to understand how we calculated walking distance had been calculated-

  Walking Distance= (ST Bus routes(Y)+ Hub distance 1 (X) + Hub distance 2(Z)) – (ST Bus Routes(Y))

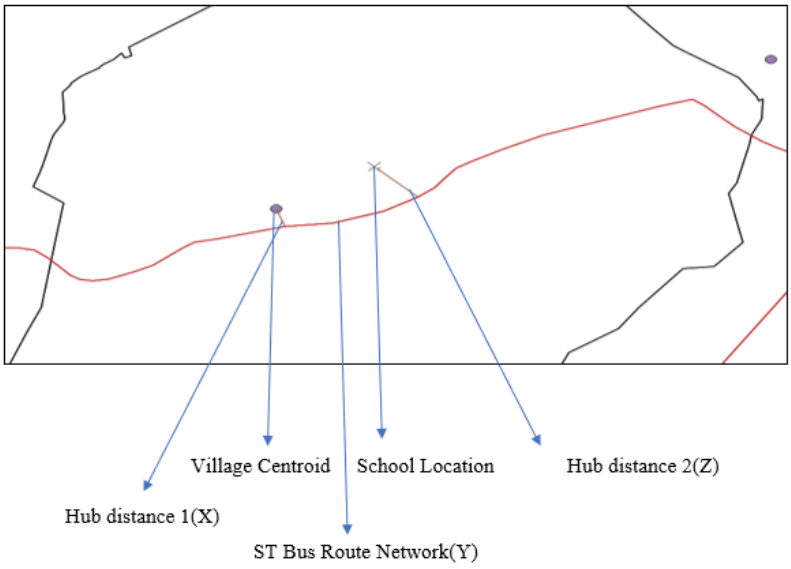


Figure 26: Shortest Distance Computation

E.g., If we take an example of Khardi School

Since this school is till 12th, we are considering that students coming from particular to study in this school for 12th standard

- We have first formed the origin-destination matrix of this school, which shows that this school is nearby to how many village centroids.
- Then we have calculated the distance of each route length, i.e., from what distance students from each village student have to cover if he/she is living on village centroid to reach this school.
- Then we calculated the walking distance by reducing the length of each projection,i.e.,projection from village centroid to ST route and Projection from School to ST route from total route length.
- Then we summed both the Projection, and if this sum is greater than 3 km, we categorized that School as a **Bad School.**

Results

From this analysis, we have selected 30 schools as **Bad Schools** based on the walking distance, i.e., where the walking distance from village centroid to school location

From this, we have chosen the following 16 **Bad schools** for the Survey as due to time limitation we have selected only upper primary/middle School and secondary School

Following is the list of 16 Schools-

School Location	**% pop. Serve**	**SC% in pop.**	**ST% in pop.**	**SC% in School**	**ST% in School**	**SC% Served**	**ST% Served**	**Distance from the road (in meters)**	**Distance from ST route (in metres)**
MOHILI	3.14	2	79	7	22	398	28	80	791
BIRWADI	2.01	1	56	0	69	0	125	31	95
KASARA BUDRUK$	2.16	15	54	45	13	297	24	20	963
TEMBHE	5.98	1	68	1	69	113	101	670	2384
FUGALE	2.35	0	85	0	99	0	116	171	3629
SUSARWADI	11.06	3	64	0	98	9	153	21	2475
PENDHARGHOL*#	10.56	2	41	0	99	0	241	2371	2371
DOLKHAMB#	6.33	4	37	4	14	93	39	92	103
SHIROL*$	1.42	9	65	2	95	21	147	103	662
PIVALI*#	3.78	0	59	1	86	529	146	48	165
VIHIGAON	6.16	2	93	2	87	105	93	347	2527
KHARDI$	4.41	3	47	5	44	160	93	108	108
PIVALI*#	15.22	0	59	0	100	0	170	48	165
DHASAI	1.79	2	48	0	2	0	4	34	989
CHANDROTI	4.09	3	74	0	87	0	118	1005	1378
TEMBHURLI	5.4	2	63	4	10	232	16	75	2654

- *# For Tribal/Social Welfare Schools and Survey done in 1st MTP
- # Survey done in first MTP
- *$ For Tribal/Social Welfare Schools and Survey Done in this MTP
- $ Survey done in this MTP

Limitations

- We do not have habitation coordinates, and in our surveys, many students provide habitations names which we have to map from
- If a school is from 1st to 12th class, then we were considering that schools built according to the walking norm for middle/upper primary schools, i.e. the walking distance of 3 km.

MSRTC and Public healthcare facilities accessibility in Shahapur Taluka

In the wake of COVID-19 pandemic, we have done a similar kind of analysis for rural public healthcare facilities in Shahapur. Since we are working in collaboration with MSRTC towards the We are working in collaboration with MSRTC towards the objective of how efficiently a depot is managed and how it caters the needs of the people of the area it covers.

The integration of transport facilities with the health infrastructure of the talukas on the web will not only help us to visualize the points of importance (the PHC and Sub-PHCs locations and the habitation that is accessing these facilities, the fatas lying on the network, etc.). Still, it will also reflect the mobility difficulties that people face.

Through PHC and Sub-PHC GIS data, we can work on trying to maximize the accessibility of PHCs to the villages through the ST road network so that maximum stations can be covered and people have to walk less.

We are designing an algorithm where we select the routes for this accessibility and for this hub and spoke model is created for a PHC and the corresponding nearest village.

Rural Public Healthcare

is essential to understand the India public healthcare system in rural areas first. It is a three-tiered structure, and sub-centres comes at the bottom of the pyramid aims to serve the population of 3000-5000 each, approximately five villages. Primary health centre or PHC is the first site for doctors generally consider as a referral unit for 5-6 sub-centres. PHCs function as the core, and flow into community health centres (CHCs), followed by sub-district and district hospitals

.

Centre	Population Norms	
	Plain Area	Hilly/Tribal/Difficult Area
Sub-Centre	5000	3000
Primary Health Centre	30000	20000
Community Health Centre	120000	80000

Table 9: Government Norms According to Population

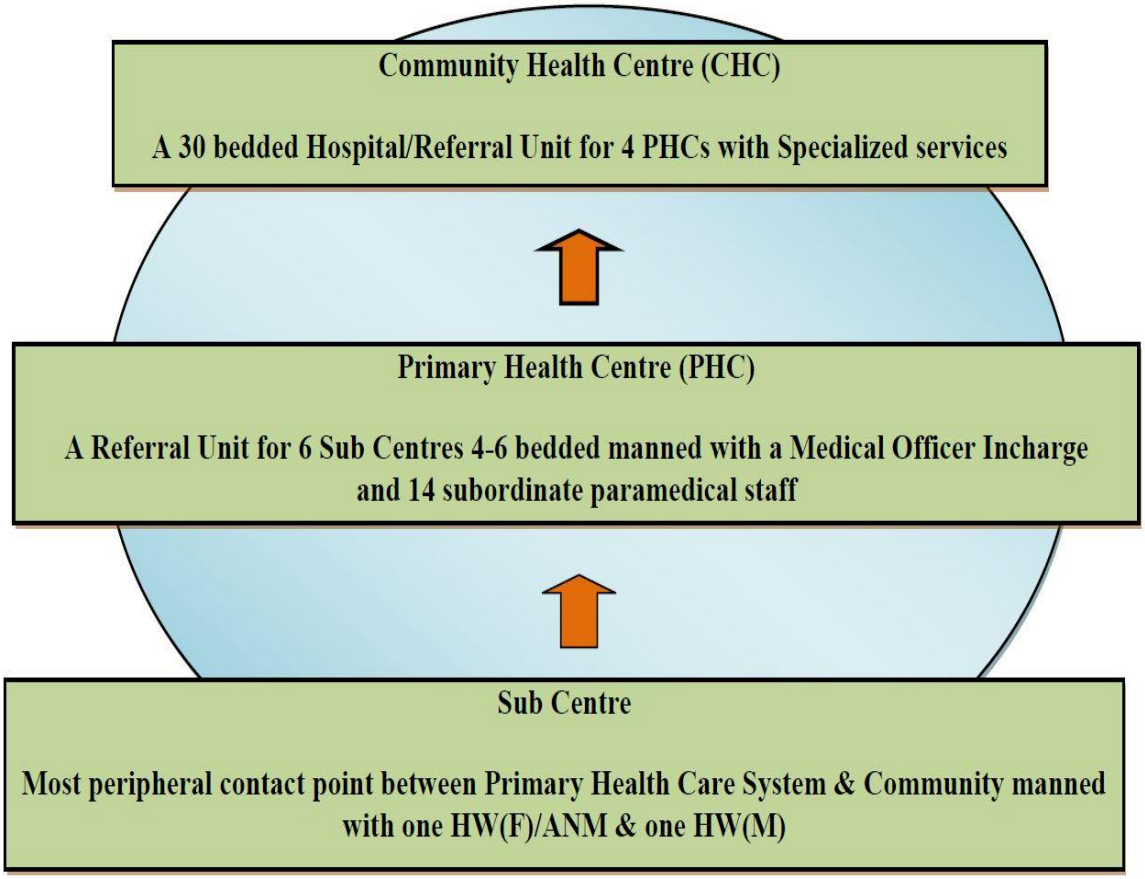


Table 10: Government Norms According to the Facilities

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Mapping Shahapur Villages to all Shahapur PHC via ST road

In this, we have used similar kind of algorithm, Hub and Spoke model which we have used to map the nearest school to the village centroid. From that, we have found out which village is closest to which PHC via road.

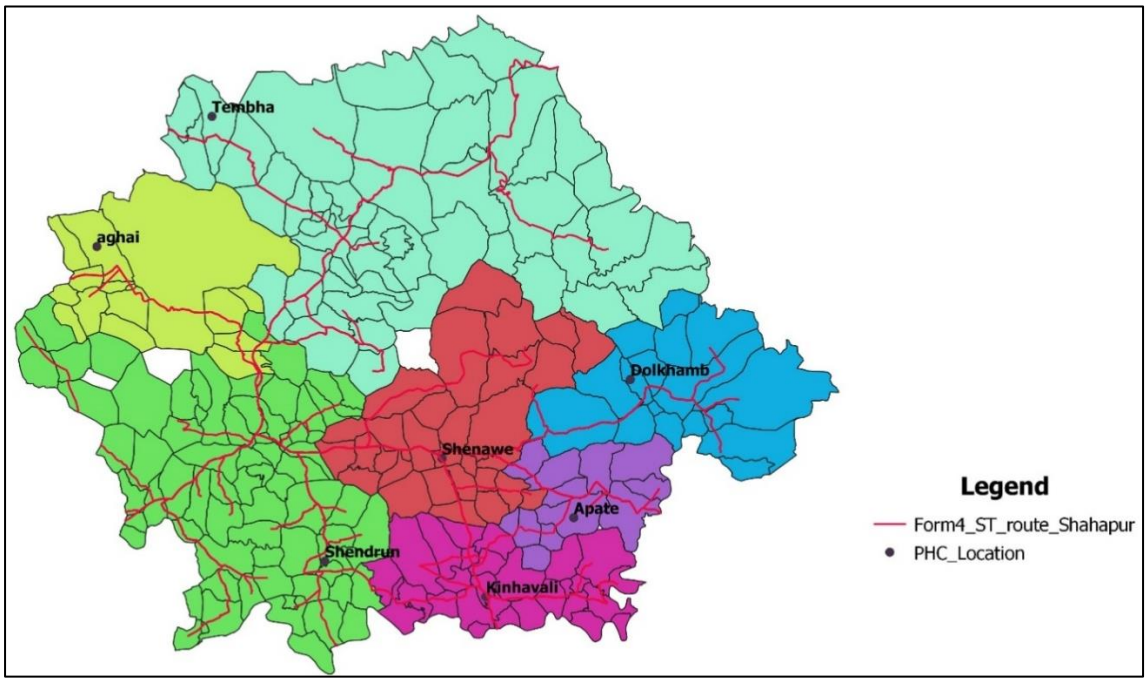

Figure 27: Shahapur PHC coverage via ST road

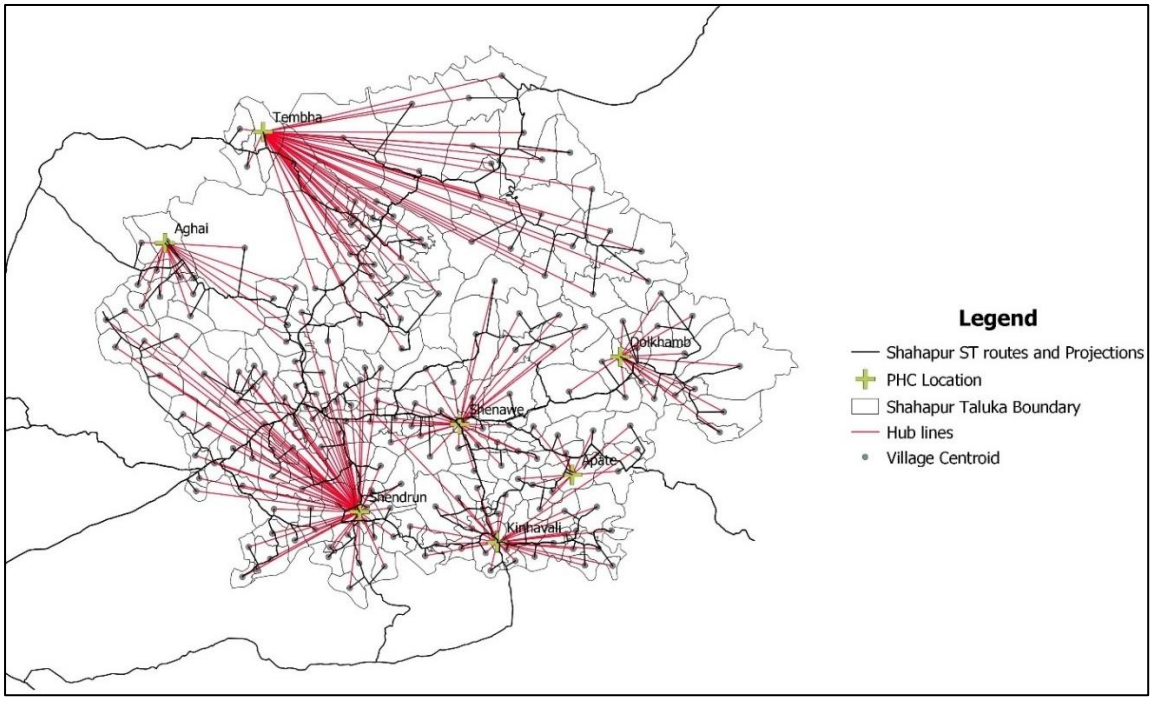

Figure 28: Hub lines Showing Village mapping with its nearest PHC

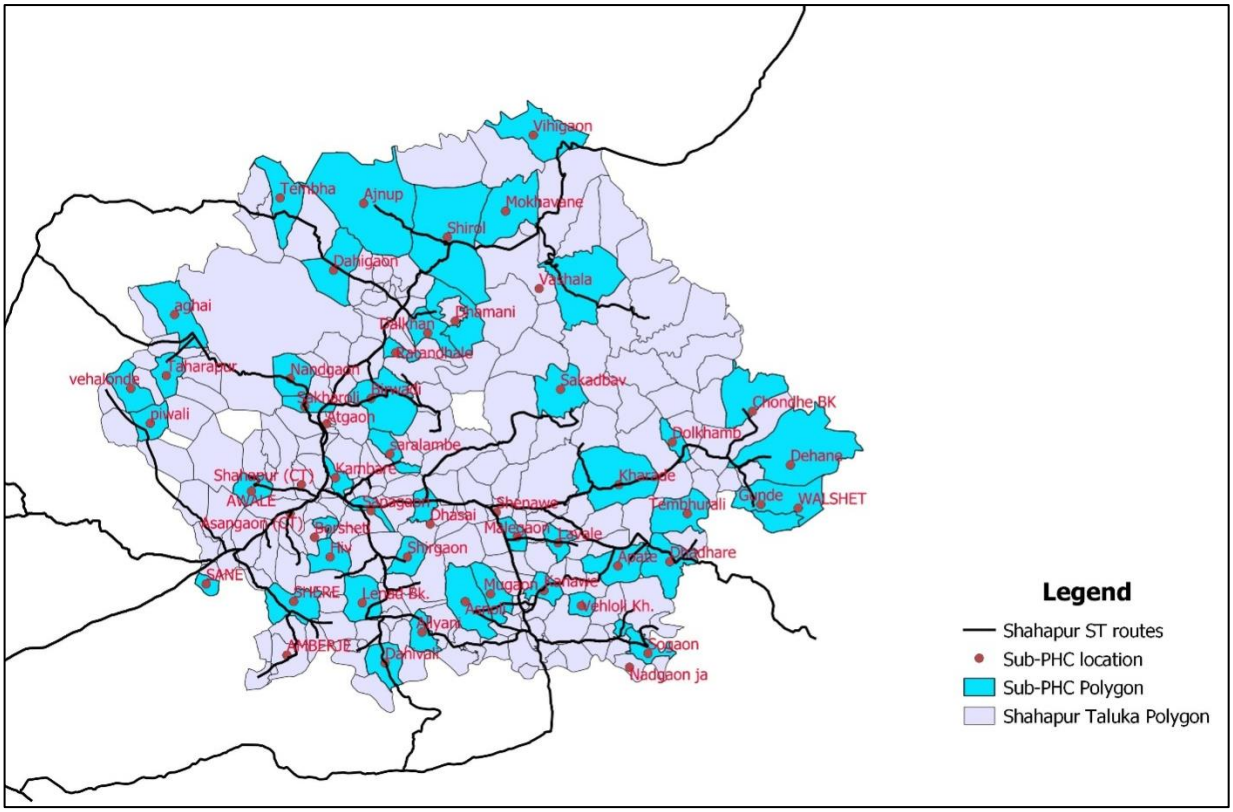

Figure 29: Shahapur Sub-PHC location and their village polygon

PHC Location	**Population Covered**	**No. of Villages Covered**	**No. of Sub-PHC under it**
Aghai	14927	15	5
Apate	10343	11	3
Dolkhamb	16928	17	6
Kinhavli	30703	28	6
Shenawe	35918	29	7
Shendrun	123049	70	15
Tembha	73623	48	11

Table 11: Shahapur Taluka PHC coverage

From the above table we can see that, apart from Tembha and Shendrun PHC all PHCs are following the population coverage and no. of Sub-PHC under 1 PHC government norms

Distance Analysis according to State transport bus route

Tembha PHC

Distance analysis for Tembha PHC

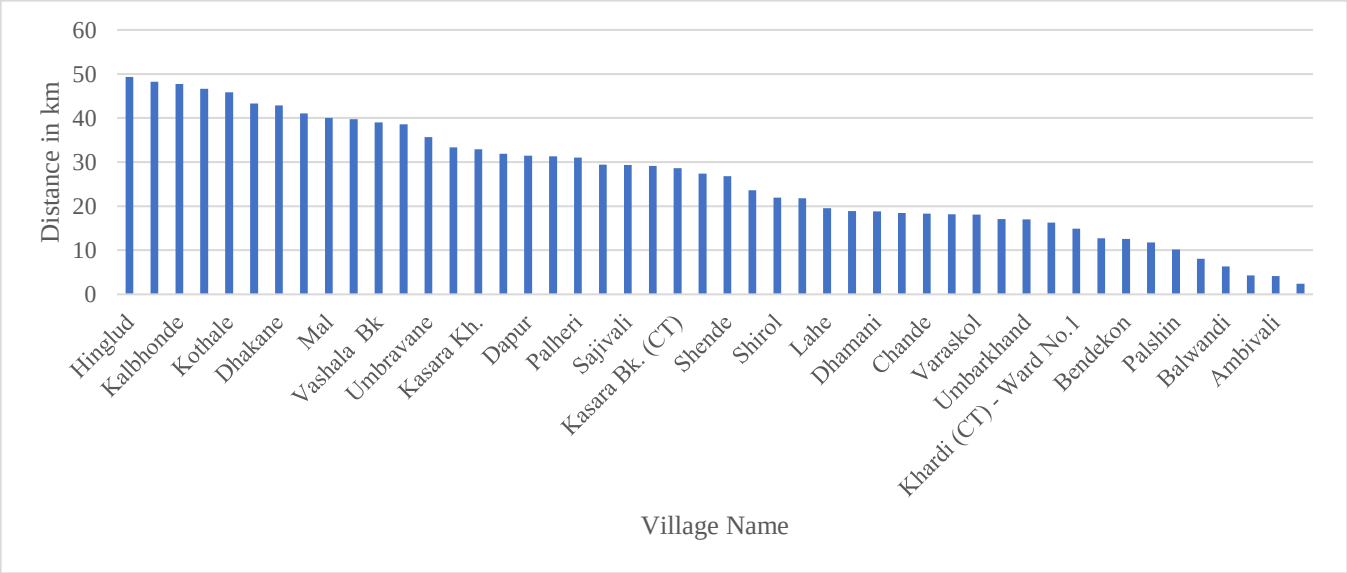

Figure 30: Tembha PHC distance from its nearby villages (distance in decreasing order)

Village Name	Distance (in km)
Hinglud	49.34
Roadvahal	48.26
Kalbhonde	47.74
Fugale	46.68
Kothale	45.85
Pingalwadi	43.33
Dhakane	42.85
Veluk	41.06
Mal	40.02
Susarwadi	39.71

Table 12: Top 10 villages from Tembha PHC according to distance

Shendrun PHC

Distance Analysis for Shendrun PHC-

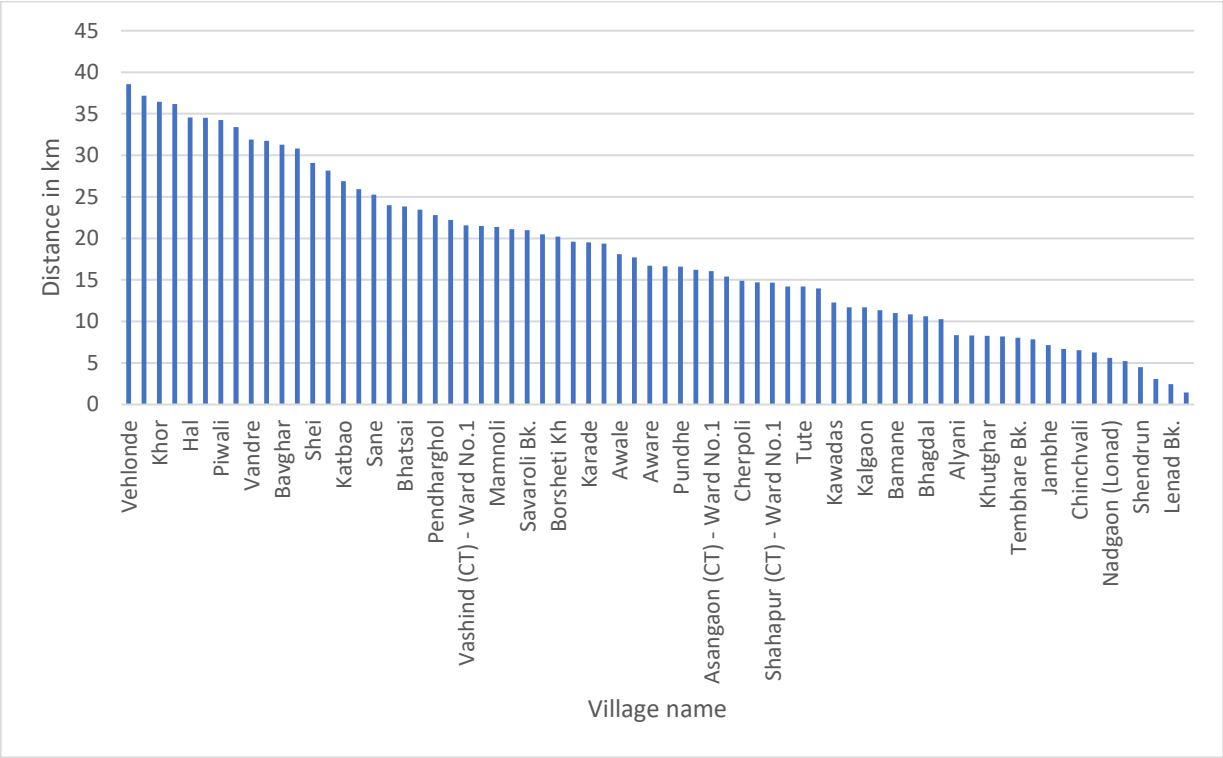

Figure 31: Shendrun PHC distance from its nearby villages (distance in decreasing order)

Village Name	Distance (in Km)
Vehlonde	38.55
Savaroli Kh.	37.18
Khor	36.45
Koshimbade	36.16
Hal	34.56
Madh	34.52
Piwali	34.23
Ghosai	33.38
Vandre	31.90
Ambarje	31.74

Table 13: Top 10 villages from Shendrun PHC according to distance

Inference from distance analysis according to State transport bus route

From the above analysis, we can see that though Tembha and Shendrun PHC is serving a large number of the population, the number of Sub-PHC under these PHCs and population served by these Sub-PHC are following the Government norm also if we look upon other aspects like Tembha PHC coverage area is less dense compared to Shendrun PHC coverage area as shown in the figure below, that can also be the reason for the large Tembha PHC coverage area.

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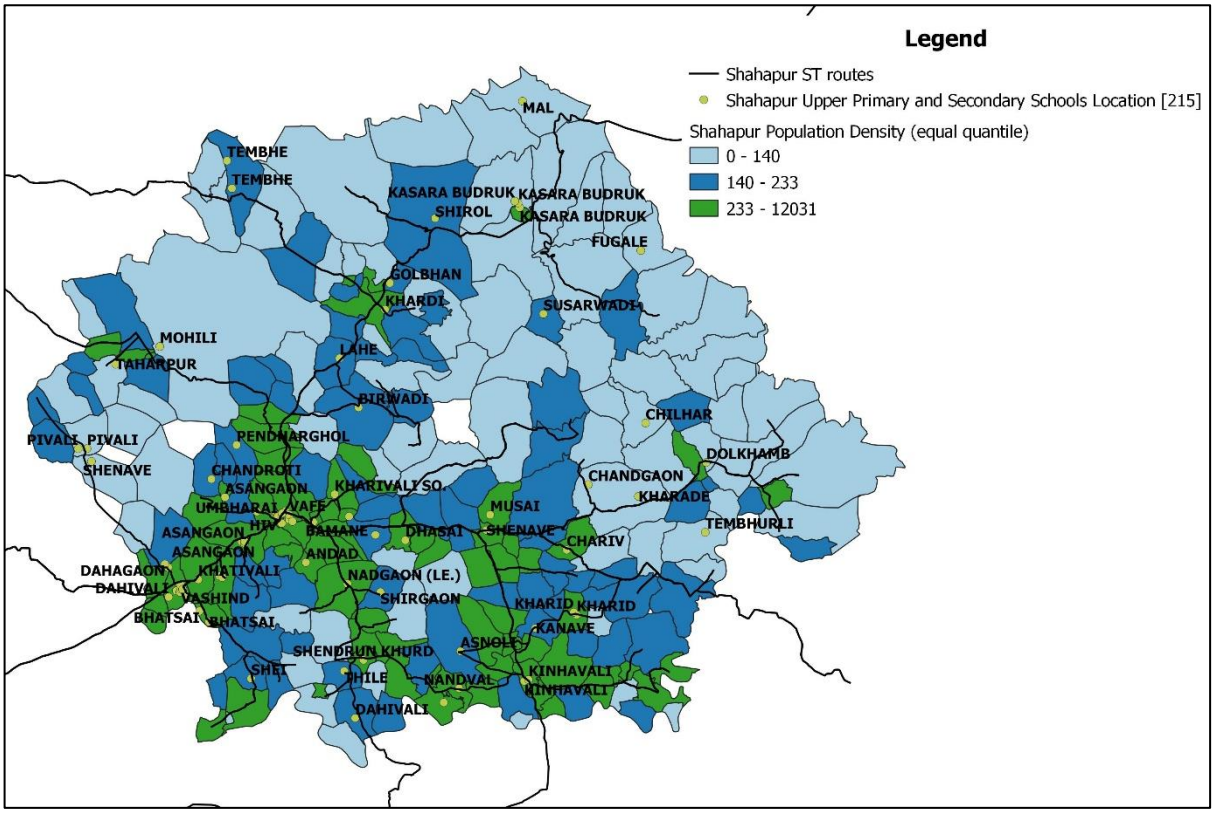

Figure 32: Shahapur Population Density trend

Distance Analysis according to taluka Shahapur taluka road

Since distance from some villages to its nearest PHC is greater than 40 km taking State transport route, so we again done an analysis taking Shahapur roads to again find the catchment area of all PHCs in taluka

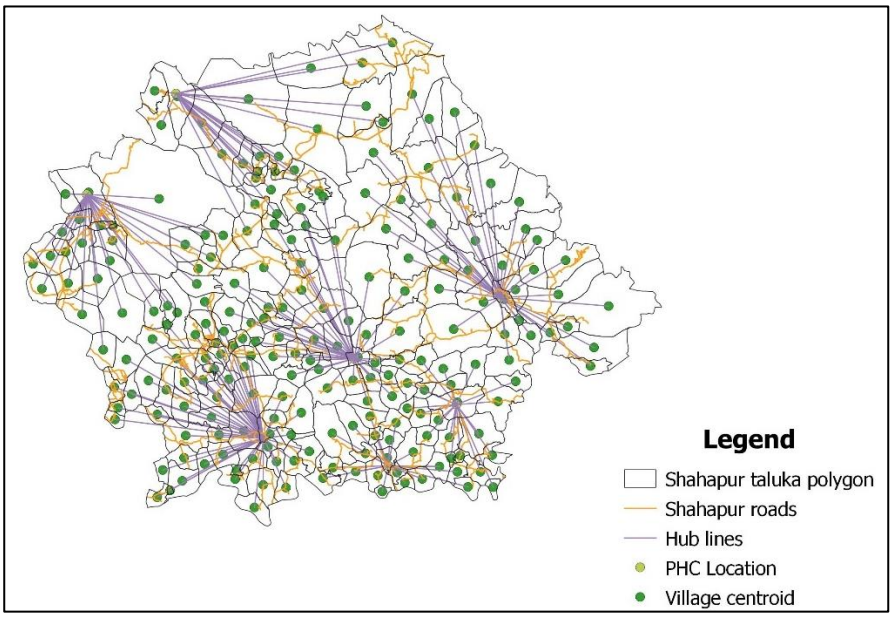

Figure 33: Hub lines Showing Village mapping with its nearest PHC

PHC Location	No. of Villages Covered
Apate	20
Dolkhamb	37
Kinhavali	20
Shenawe	39
aghai	28
Shendrun	55
Tembha	24

Table 14: Shahapur Taluka PHC coverage

Their coverage area is uniformly distributed and if we look into below graphs for distance analysis of some PHCs we can also see that distance to nearest PHC from village centroid is not more than 20 km from which we can infer that due to the wide network of taluka roads than State transport bus route it is easier to reach nearest PHC in less time (considering road conditions also) by taking road than Government buses if they have access to other mode of transport like private/non-MSRTC operators or own vehicle on that route.

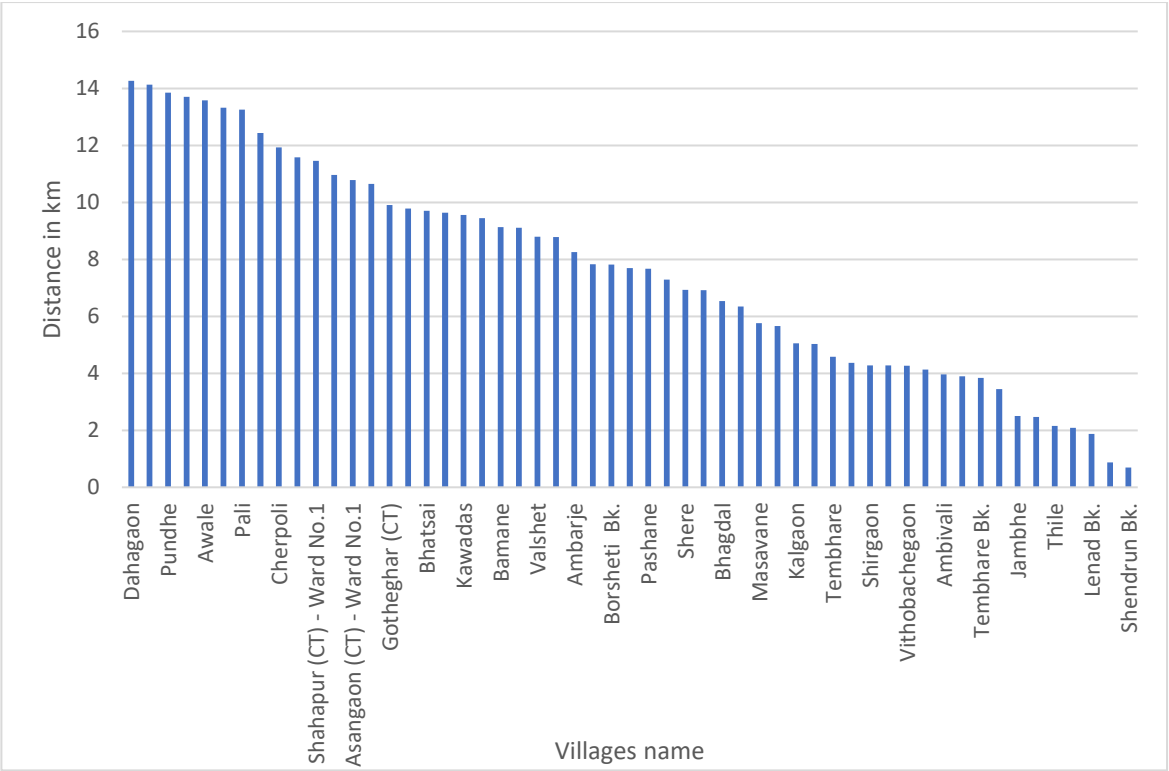

Figure 34: Shendrun PHC distance from its nearby villages (distance in decreasing order)

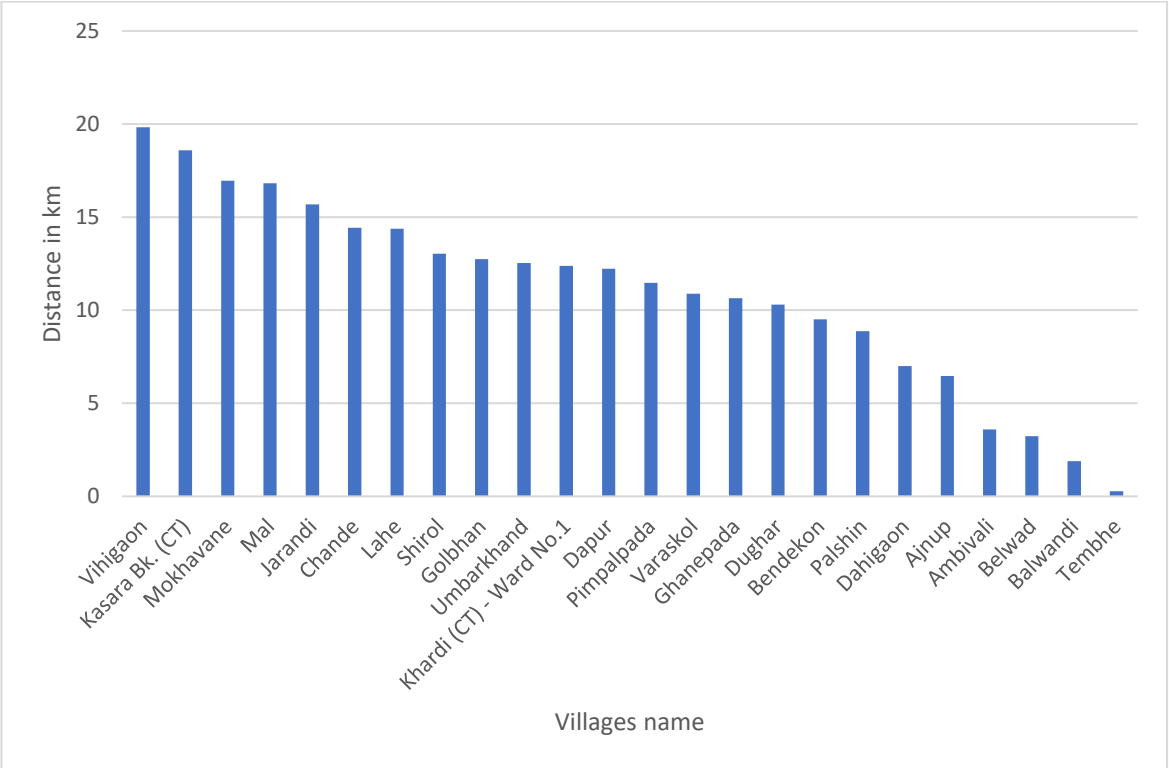

Figure 35: Tembha PHC distance from its nearby villages (distance in decreasing order)

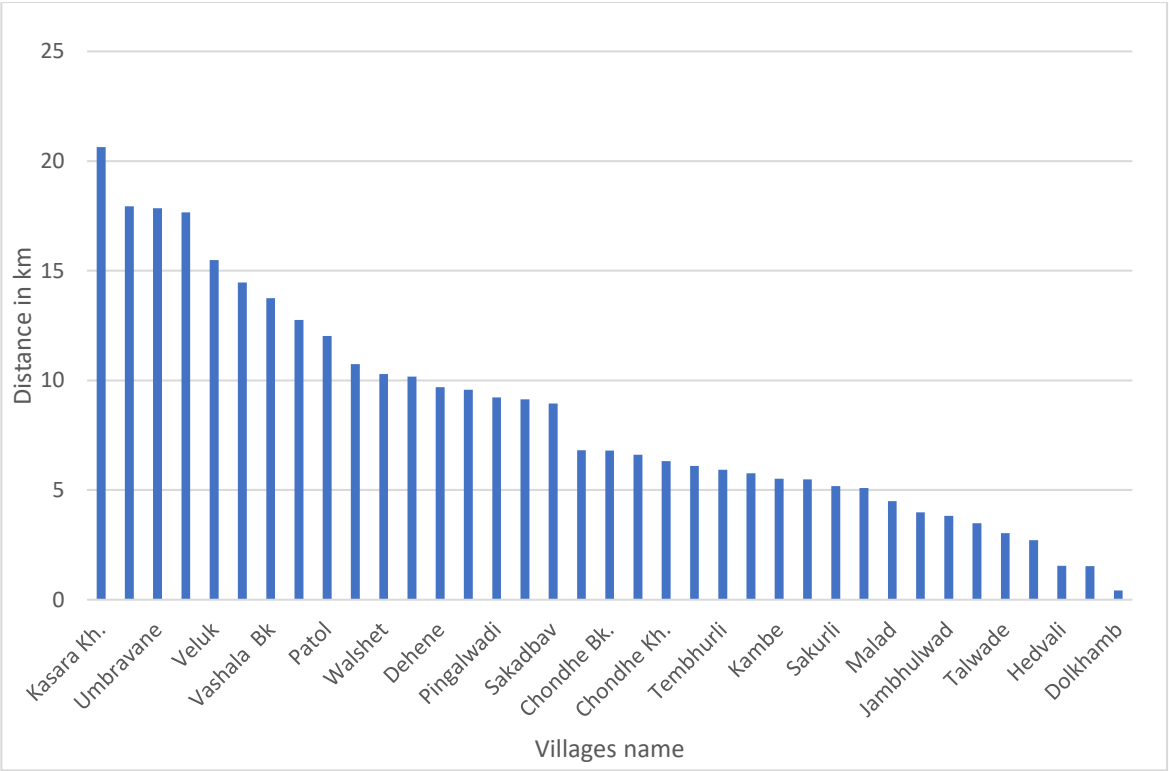

Figure 36: Dolkhamb PHC distance from its nearby villages (distance in decreasing order)

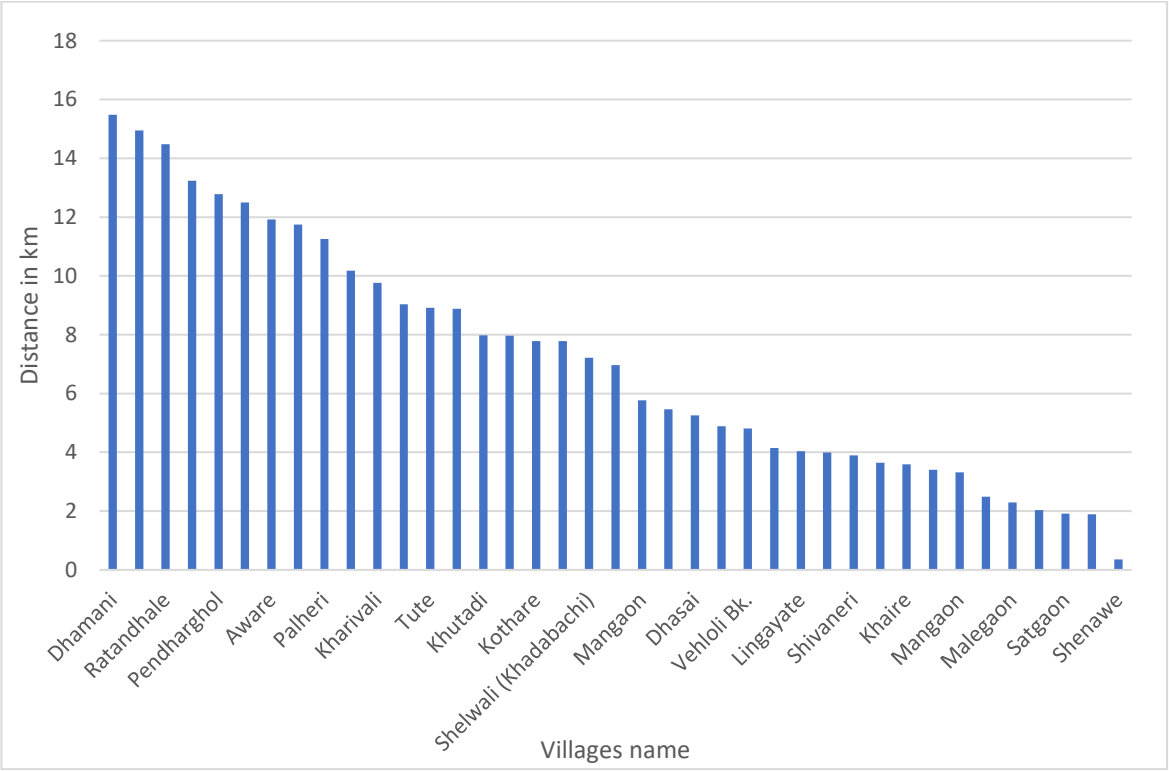

Figure 37: Shenawe PHC distance from its nearby villages (distance in decreasing order)

Chapter 5: Field Work

Fieldwork is an integral part of Public transportation planning process. Fieldwork carried out in selected Shahapur Taluka Schools and Shahapur Taluka Bus-Depot. Interviews and surveys were carried out for stakeholders like students and teachers.

Objectives

To develop a reasonable understanding of travel mode choice behaviour for school trips in Shahapur Taluka based on primary data collected. The field study gives some essential insights into travel mode types used for school trips and the factors affecting these choices.

Plan of Field Work

Pre-requisites

We took the permission to survey in Shahapur Schools which we termed as Bad Schools from BDO of Shahapur Taluka and also for acquiring Shahapur school's enrolment data of last ten years (Caste wise, village wise, gender wise and income-wise), to know the effect of the development of Public transport in taluka on education accessibility. Second Set of the permission was required from the Principal of that School. The third set of consent is needed from Thane divisional office, to travel in Shahapur Taluka MSRTC buses, as according to MOU signed between MSRTC and IIT Bombay, free travel and stay in MSRTC buses and guesthouses respectively will be provided by MSRTC for our research work.

My fieldwork was planned in the following manner-

- Meeting with BDO and present our work regarding these Bad Schools and asking their permission for both Survey and data acquiring. (However due to COVID-19 all offices get shut down, and we couldn't get that data)
- Meeting Shahapur Taluka Depot Manager and understanding about Manav Vikas service in taluka.
- Meeting School Principal telling about them about our work and showing them our survey questionnaire and also took permission from them for surveying that school
- Interviewing Principal and surveying the students at the school

Schools Visited

Kasara School-

- School Name- New Wonderland Eng. Kasara
- Management Type- Private aided School
- Classes- 1st to 10th
- No. of students- 538
- Informal Interaction with Principal and surveyed the students
- From that, we got to know that all students coming to this school is from Kasara itself and they are either coming by walking or by their transport

Shirol School-

- School Name- S. Ashram Shirol Primary
- Management Type- Tribal/Social Welfare
- Classes- 1st to 12th
- No. of students- 631
- Informal Interaction with Principal
- Since it is a residential school, therefore, all the students coming from more than 5 km radius of school is living in hostels and who are living within 5 km have the option to live in the hostels or not

Khardi School

Primary data collected

A field survey has been conducted in which 99 surveys have been done in Khardi School.

Important points about school

- Total village served (from the hub and spoke model) =27 (Allocation from MTP1)
- Name of the School= Khardi Vibhag Education Society's Highschool and Junior College
- School Management type= Government-aided School
- Total Children enrolled= 1333 (According to DISE Data)
- Classes= 5th to 12th
- Boys Enrolled =692
- Girls Enrolled =641

- Sampling- Minimum one boy and one girl from each habitation
- Samples taken=99 (56 Boys and 43 girls)
- Class = 6^{th} to 8^{th} (Since board exams are going on class 10^{th} and class 9^{th} students are unavailable at that time.)

Survey Method

S.No.	Question	Type	Purpose
1	Age	S	To understand the mobility pattern according to age
2	Gender	S	To understand how gender affects the transport accessibility
3	Village	S	to understand which villages are major source of transportation in taluka
4	Caste	S	to understand which community is active in non-MSRTC transportation
5	Types of Vehicles Used for School commuting purpose	S	To understand the type of vehicle used for school commuting purpose
6	Reasons for not taking Government bus	US	To understand the reasons why students are opting for other modes of transport
7	Which mode of transport or a combination of transport takes the most amount of time?	SS	This is for those students who are either taking multiple modes of transport for commuting purpose or taking a different mode of transport on different days
8	Occupation	US	To understand their household occupation
9	If a mother is also working	US	To understand if working mother affects the second gender transport accessibility
10	Any other comments?	US	To understand some type questions like if they are coming to school with their peers or not and will their friend mode of choice for travel affects their decision also

Table 15: Survey Questionnaire Design

where,

S: Structured

US: Unstructured

SS: Semi-Structured

Tools: ODK Build to build the Survey,

Survey Results

Catchment map

As we can see from the figure given below that

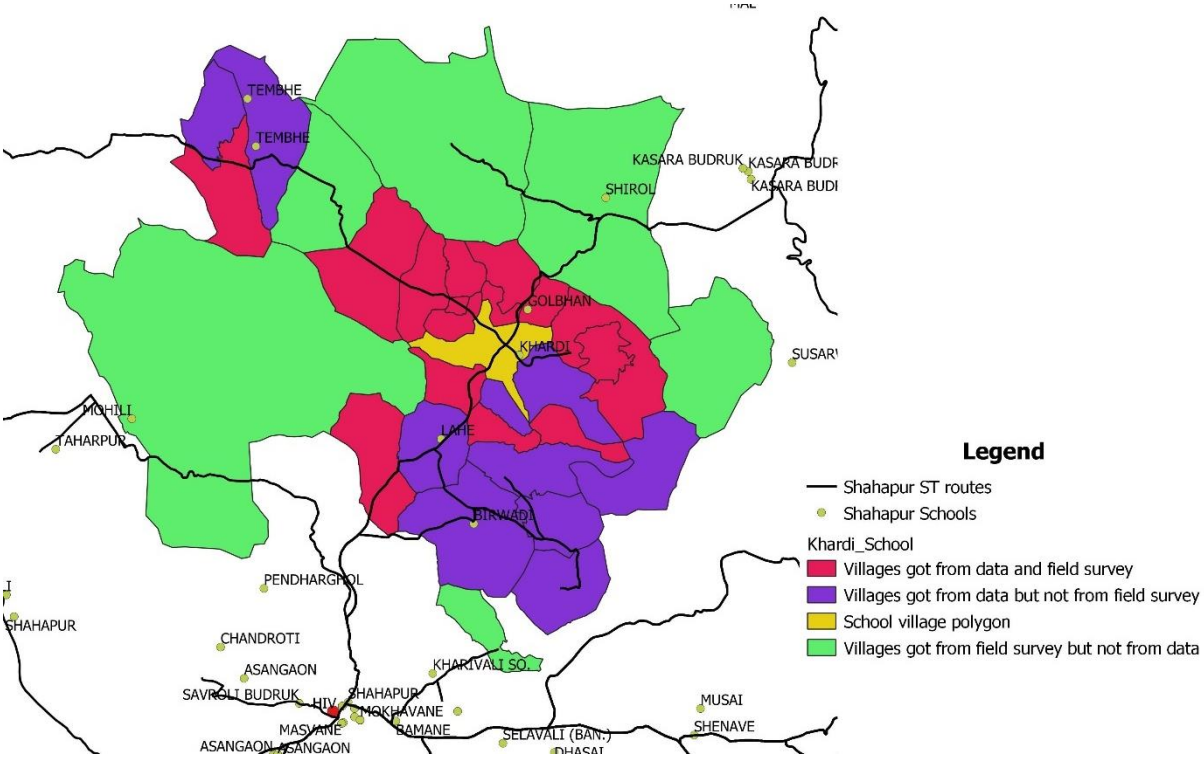

Figure 38: School Catchment Map (Actual vs Data)

Data vs field observation-

To understand this data vs field observation better for, we have to look upon the schools which are falling in that particular catchment area-

School	Classes	Management type
Golbhan	1st to 7th	Local body management
Shirol	1st to 12th	Tribal/social welfare
Birwadi	1st to 8th	Local body management
Lahe	1st to 8th	Local body management
Mohili	1st to 8th	Private Unaided
Tembhe	5th to 10th	Government-aided
Tembhe	1st to 8th	Tribal Social Welfare

Table 16: Schools in coverage area

1. If we consider school management type, then two schools are of tribal/social welfare in which hostel facilities are there for all SC and ST students who are living outside 5 km radius of the school (this is according to rule) and voluntarily for students who are living within that range. However, there is no hostel facility for General/open and OBC category students. Still, out of 2 schools, only Shirol school have 18 students from OBC category (no general/open students in both the schools). Since this Shirol school comes under our selected schools, so we have also done a survey there and found out that no student is coming from more than 2 km radius of the school.Mohili school is private unaided, so we are excluding this school also due to fees concern.
2. Out of 4 left out, three are managed by the local body, i.e. ZP schools and all are up to 8th class only.
3. From our field observations, students prefer Government aided schools over ZP schools due to 2 reasons-
    a. **Medium of instruction**- Medium of instruction is Marathi in all ZP schools whereas English is taught in these Government aided schools
    b. **Infrastructure**- Many ZP schools lack necessary facilities like electricity, labs also teachers would hardly present in the class (these observations are from my 2-month field stay experience)

Also, if we look upon the figure showing population density of Shahapur Taluka, we can see that south side of Shahapur taluka is more densely packed than north side and even southern part

have more number of schools than the north side that can also be the reason for northside schools large catchment area

Mobility options

- This school is approximately 1.5 km away from Khardi railway station. Hence, students who are living near to any local station like Oombermali or within 15-20 km walking distance from railways station, travel to school by rail only. These students generally go to school by walk from the railway station. Apart from this, you can also take an auto which is always present there and takes 10rs per journey from the railway station to school.
- It is also 100 metres away from the main road and ST bus route where you can find both the ST bus and jeep to reach Shahapur as we can see from the figures below. Also, it is easy to find jeep on that route as they are always standing.

Figure 40: Khardi School from ST road

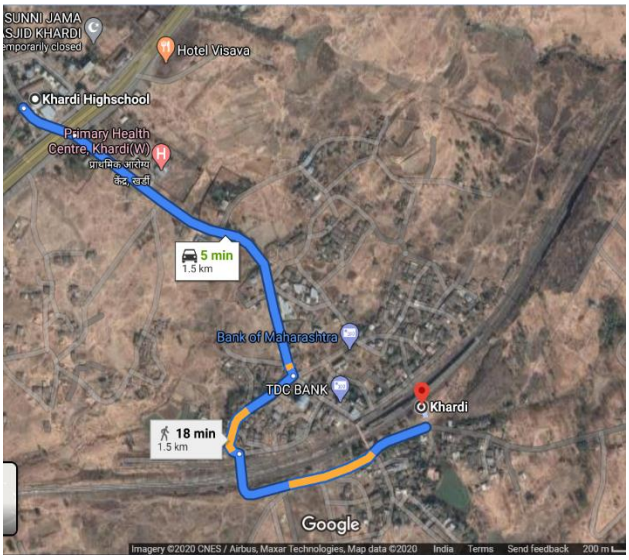

Figure 39: Khardi School from Railway Station

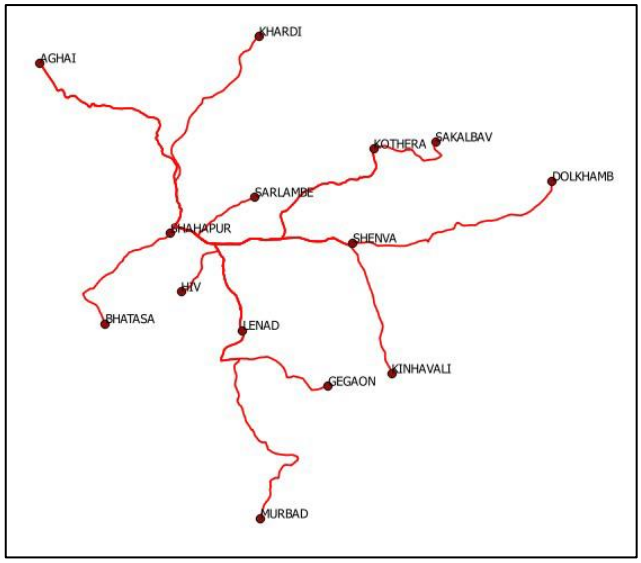

Figure 41: Jeep operated routes in Shahapur

- Also, it is well connected by a seasonal road which makes it easy for those students who are to coming to school by walk.
- If we compare bus service count of same type school, i.e. Tembhe and Khardi schools as both of these schools are Government aided, then Khardi has a greater number of bus service count than Tembhe. Also, Khardi School is connected by Manav Vikas route, as shown in the figure below.

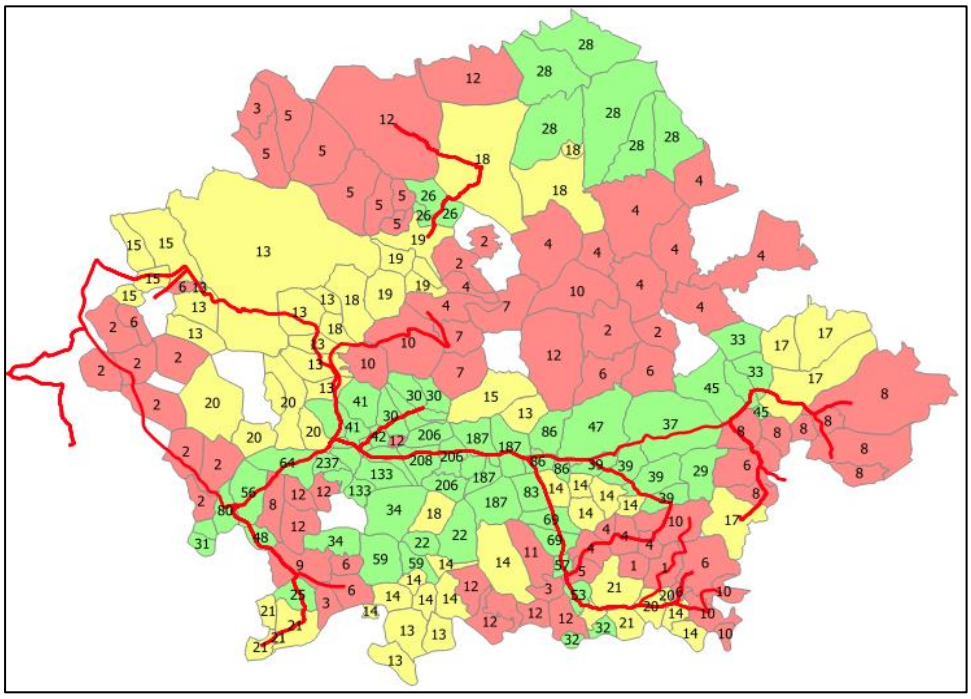

Figure 42: Bus service count at villages and Manav Vikas Routes

Travel mode choice

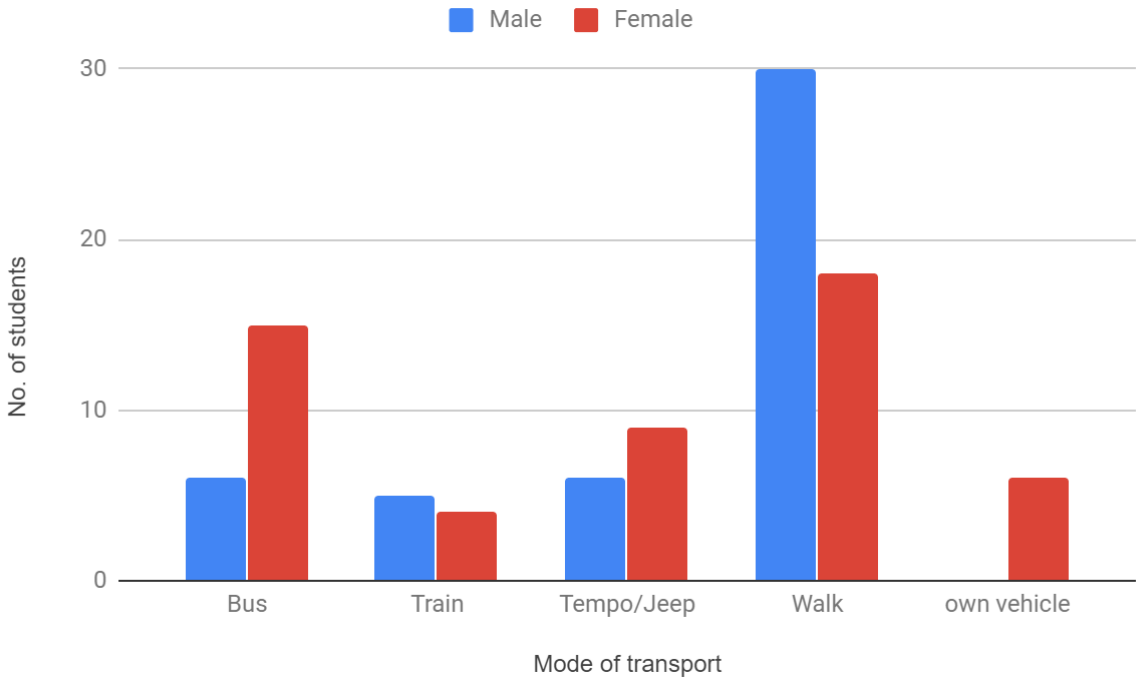

Figure 43: Student Travel Mode Choice (Sample Size=99)

- As we can see from the graph most of the students coming to school is by walking (Although it is only a representative sample)
- Those who are travelling by jeeps and autos get these vehicles easily as their stops are either in their village or nearby their village.
- Also, jeep less time than any public transport as they do not have multiple stops like them.
- Female Students who are travelling through tempo/jeep complaint that these jeeps owner overloaded these jeeps as they generally carry 16 passengers in their seven-seater jeep, which make travelling uncomfortable for them
- Girls, who are coming to school by their vehicle are going alone as they do not have any peer from their habitation/village to accompany them, and also do not have any access to public transport, so they are dropped off by their parents
- Students who are travelling by walking they complain that they do not get a bus on times either bus is 3 to 4 hours before school time, and they do not have jeeps and autos stops nearby their village, therefore, they have to travel by walk only.
- Among those who did not use the bus (most of the times during their "to school") is because of lack of space availability in the bus or usually bus got late (4 times a week).

Although Manav Vikas bus is running on this route bus it also gets late very often, also students complain about the cleanliness in the bus.

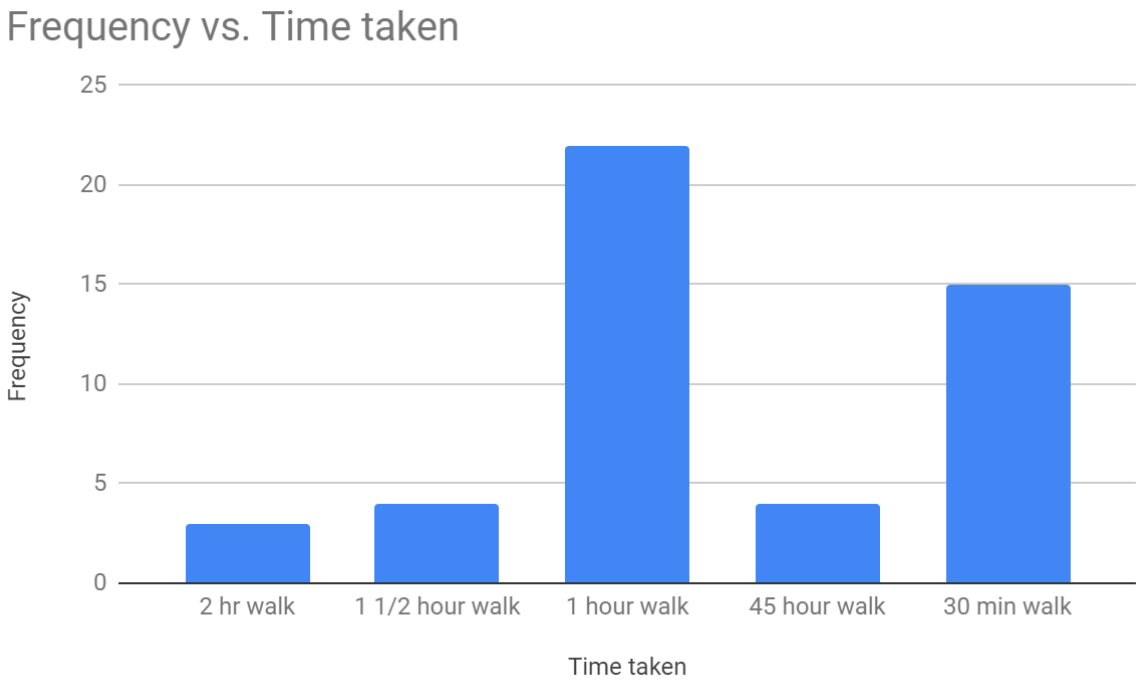

Figure 44: No. of students according to the walking time (no. of sample= 48)

- As seen from the figure above we can infer that, as the distance of school increases from student's habitation they start to resist to go that far school by walk, also if look from a safety point of view for girls, than $1^{1}/_{2}$-2 hour walk, means they will reach their home around 7 pm which is very late as it starts getting dark at that time (Considering school end time at 5 pm) which is also a safety concern for them and also increases their dropout rates

ETIM/Ticket Analysis (for school trip)

- From Form 4 we have mapped out Manav Vikas buses whose timings are matching with school timings
- And from that, we have taken out the matching trips from ABC data
- From the master file, we have identified the trip routes for analysing the route coverage
- We have found out following four trips-
    - Route_no - 3905 - Khardi to Mengalpada
    - Route_no- 16555 - Mengalpada to Khardi (return trip)
    - Route_no- 18346 - Mengalpada to Shahapur

    - Route_no- 72365 - Shahapur to Mengalpada (return trip)
- The villages covered by these trips (village coverage was taken out from QGIS) have been verified by ticketing data
- From this, we infer that It may be possible that in the Survey we conducted might not have any student from the southern region of Khardi, but from the data, it is very clear that it caters the southern region villages as well--(Kukambe, Lahe, Ratandhale, Birwadi, Sajiwali), where frequent tickets have been issued for Ratnadhale and Lahe, mainly. But when we check the timing of these tickets, it is mostly in the afternoon say around 1pm, which means the service is used by the students of class 11th and 12th, because their school gets over at 12noon.

Timing analysis of Manav-Vikas trips

From	To	Bus Service Type	Timing Analysis	No. of Passengers	Earnings from ETIM	abc status
KHARDI	MENGAL PADA	DO	on_time	729	14580	C
MENGAL PADA	KHARDI	DO	late by more than 40mins daily	851	17020	C
KHARDI	MENGAL PADA	DO	late by 30mins daily	506	10120	C
KHARDI	MENGAL PADA	DO	on_time	1118	22360	C
MENGAL PADA	KHARDI	DO	late by 25mins daily	101	2020	C

Table 17: Timing analysis for 5 trips found from ABC data (Manav-Vikas trips)

The last two attributes are the results of the timing analysis, which is done using the ETIM data. The earnings are almost double for all the trips the reason being we do not have the extra trips mapping, and also the fare is taken as Rs.20 (as stated in ABC data), and it might be possible that not all the passengers travelled from stop 1 to the last stop, hence variable fare for all the tickets as per the stage_no

Other Field Observations

- No remarkable difference was found between journey "to school" and travel back "to home," i.e. all the students who are coming to school by a particular mode of transport, returning by the same mode of transport only.
- In an informal interaction with the Principal of the School, we get to know that children from 28-29 villages are coming to this school for studying, he told us some names of villages like Kasara. However, we didn't find any student from there in our Survey. Since Kasara is well connected to this school by both road and rail, it might be a possibility also. Also, we have conducted our study in one Kasara school (as it was also included in our selected **Bad schools'** list), which is a private unaided school and. We get to know that all the students coming to this school is only from Kasara and all belongs to the service class family who is coming either by walking or by their transport.
- As this school is from the 5^{th} class, students are coming to this school after studying primary school in some other school. So we have an interaction with students, to know about the effect of this change in school on dropout of their friends, we came to know that students find it difficult to continue their secondary education after attending primary schools in their areas, especially girls and one of the reasons which many girls mentioned, that a lot of their fellow girl students drop out from studying further because as the school change, distance increase and they do not get proper access to public transport which is anyway safer than private/local transport., so they have to cover this distance mostly by walking or by travelling in Jeep/auto which is very uncomfortable for them. Moreover, state transport is cheaper than all other means especially for girls as they got a free pass to travel on State transport buses due to Savitribai Phule Yojana.
- A notable finding of this study is the "second gender effect" on the travel mode choice. Girls, in comparison to the boys, were less likely to travel independently and odds were high that they would be dropped off by their parents or they accompanied by their peers in public transport.
- Sometimes the bus doesn't come/cancel, and also the next bus is after 1-2 hours, so they have to take a jeep, auto or take a lift from someone on a motorcycle. In this case, girls suffer most as they do not have money to pay to travel from the jeep, as they are provided free bus passes to go in MSRTC buses and cannot take lift due to safety issues which affect their attendance in school at that day.

- Another problem identified with public bus transport is, breakdown of the bus in midway (2 to 3 times a month) which compels students to take jeep/auto or sometimes go "to school"/" From school" by walking as depot have exact no. of buses according to form4 schedule.
- The main problem arises when the rainy season starts and due to lack of public transport in vicinity children from far away villages, where they have to travel to school through the walk, have to miss the school, due to bad condition of roads. This happens to those students also who are living around 2 km away from the bus stand.
- As per PMGSY, every village should have a road, but MSRTC still do not have clearance to run its services, so if MSRTC gets the PWD clearance, then a service can be started on that route. And if not, then local transportation should be made accessible to the people of that village. Or MSRTC can provide feeders (some other transport facility, be it an auto, or tempo, or minibuses, etc) on that route.

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Chapter 6: Conclusion

In this, we try to understand the impact of public transport on the accessibility of the education sector in Shahapur taluka. After integrating the Shahapur taluka shapefiles and CensusGIS data we have selected some pockets and surveyed some schools also, it was seen that the field observation is in congruence with what comes from research paper and literature review. However, due to unprecedented COVID-19 situation, we annot do further work like acquiring and analysing last ten years enrolment data and surveyed or visit the villages from where enrolment number is consistently low or decreases or increase at a prolonged rate compared to the whole taluka to know how the scenario changes in the education sector due to the development of public transportation system.

After looking into the catchment area (according to spatial accessibility) of south-east part of Shahapur schools, we think that public transport plays a major role in education accessibility for these schools, mainly senior and higher secondary schools which are fewer in numbers, as these large catchment area and less densely populated area indicates the scattered population which requires safe and reliable transportation system for travelling these large distances which MSRTC can provide. Also, when we compare our analysis (distance to nearest school from student's residence) from 71st survey NSSO data which indicates school accessibility from school residence, we found that our analysis is in congruence with the data.

In my view, ideal or better public transport system possess qualities like Predictability, reliability, accessibility, availability, affordability and must be gender-neutral and gender empathetic for disables. However, from the Survey also, girls foremost demand from transportation system is safety, apart from this student's wishes for convenience, reliability and accountability from public transport, when all these factors come on the same page. I am sure that education will flourish in every part of the country. Same on this line when public transport service in an area improve, then definitely it will promote social profitability not in the education sector but in other areas like employment, health etc. If the bus comes to the village, then it will improve the accessibility of that village which will eventually help to the inflow of money in the village which will result in improving the standard of living in the area, which also improves the no. of children going for higher education and solve early girl marriage issue.

Chapter 7: Future Scope

- Study of how public transport is serving other services like employment, health etc. in taluka.
- Analyse the data and carry out Survey where MSRTC is present but then also enrolment no. is low.
- Customizing Taluka bus transport system according to services present in the taluka and finally optimizing it.
- Feeder Concept- If 44-seater bus cannot be run on a particular can we run an alternative vehicle like minibus, autorickshaws, jeeps etc. which can act as a feeder to MSRTC which also help the corporation to get passengers from those areas also where its penetration is very little or negligible. It also helps the corporation to cut down its non-obligatory loss-making services.
- Study of schools catchment area according to socio-economic condition of the region.

Chapter 8: Appendix

Shahapur Schools distance from ST route network and road network

Primary Schools (only)

School code	Schools location	Distance from ST route (in meters)	Distance from road (in meters)
27211217202	AAWARE	184	108
27211220701	ADIVALI	439	43
27211220702	ADIVALI	184	108
27211200104	AGHAI	1243	1039
27211200106	AGHAI	184	108
27211200112	AGHAI	184	108
27211201109	AJNUP	268	38
27211201105	AJNUP	184	108
27211201104	AJNUP	184	108
27211201106	AJNUP	184	108
27211201102	AJNUP	184	108
27211201103	AJNUP	184	108
27211201107	AJNUP	184	108
27211201402	ALYANI	184	108
27211201403	ALYANI	184	108
27211208401	AMBEKHOR	439	43
27211208403	AMBEKHOR	184	108
27211208402	AMBEKHOR	184	108
27211214603	AMBIVALI	439	43
27211214602	AMBIVALI	184	108
27211214601	AMBIVALI	184	108
27211208601	APATE	680	464
27211208603	APATE	680	464
27211215901	ARJUNALI	184	108
27211217105	ASANGAON	268	38
27211217106	ASANGAON	110	41
27211217108	ASANGAON	235	79
27211217112	ASANGAON	235	79
27211220601	ASHTE	184	108
27211201503	ASNOLI	184	108
27211201504	ASNOLI	184	108
27211201505	ASNOLI	184	108
27211214501	ATGAON	184	108
27211209402	AVALE	63	52
27211209401	AVALE	184	108
27211209404	AVALE	184	108
27211209403	AVALE	184	108
27211212501	BABARE	184	108
27211210401	BABHALE	373	410
27211214701	BALVANDI	184	108

27211216701	BAMANE	184	108
27211218502	BAVGHAR	439	43
27211218501	BAVGHAR	184	108
27211220801	BEDISGAON	184	108
27211220201	BELAVALI	184	108
27211220202	BELAVALI	184	108
27211214801	BELVAD	439	43
27211202801	BENDEKON	45	26
27211203901	BHAGDAL	184	108
27211203902	BHAGDAL	171	86
27211200202	BHAVASE	184	108
27211200201	BHAVASE	171	86
27211200203	BHAVASE	775	94
27211202002	BIRWADI	184	108
27211202004	BIRWADI	184	108
27211202005	BIRWADI	95	32
27211202003	BIRWADI	95	32
27211202101	CHANDE	1229	774
27211217502	CHERPOLI	184	108
27211217501	CHERPOLI	184	108
27211210704	CHIKHALGAON	439	43
27211210702	CHIKHALGAON	439	43
27211210705	CHIKHALGAON	184	108
27211210703	CHIKHALGAON	184	108
27211210701	CHIKHALGAON	830	254
27211205401	CHONDE KHURD	184	108
27211213605	CHONDHE BUDRUK	63	52
27211213606	CHONDHE BUDRUK	63	52
27211213602	CHONDHE BUDRUK	184	108
27211213603	CHONDHE BUDRUK	184	108
27211213601	CHONDHE BUDRUK	184	108
27211209702	DAHAGAON	73	21
27211209701	DAHAGAON	184	108
27211214904	DAHIGAON	184	108
27211214907	DAHIGAON	184	108
27211214908	DAHIGAON	184	108
27211214906	DAHIGAON	184	108
27211214903	DAHIGAON	184	108
27211208701	DAHIVALI	184	108
27211204102	DAHIVALI	184	108
27211202904	DALKHAN	439	43
27211202903	DALKHAN	63	52

27211202906	DALKHAN	184	108
27211207001	DAND	2411	2423
27211201201	DAPUR	184	108
27211201202	DAPUR	184	108
27211206303	DEHENE	184	108
27211206305	DEHENE	184	108
27211214001	DEVGAON	184	108
27211220302	DHADHARE	439	43
27211220303	DHADHARE	439	43
27211220305	DHADHARE	63	52
27211220301	DHADHARE	184	108
27211220306	DHADHARE	184	108
27211222101	DHAKANE	635	226
27211222103	DHAKANE	439	43
27211222104	DHAKANE	184	108
27211203003	DHAMANI	51	13
27211203001	DHAMANI	51	13
27211204604	DHASAI	439	43
27211204603	DHASAI	184	108
27211200301	DIMBE	439	43
27211205505	DOLKHAMB	184	108
27211205504	DOLKHAMB	184	108
27211205501	DOLKHAMB	184	108
27211205506	DOLKHAMB	184	108
27211208801	FOFODI	439	43
27211222202	FUGALE	184	108
27211222201	FUGALE	3629	172
27211201602	GEGAON	184	108
27211203301	GHANEPADA	439	43
27211211501	GOKULGAON	645	645
27211217602	GOTHEGHAR (MAUJE)	439	43
27211217601	GOTHEGHAR (MAUJE)	439	43
27211206401	GUNDE	184	108
27211218701	HAL	439	43
27211205701	HEDAVALI	184	108
27211205801	HINGLUD	184	108
27211216803	HIV	184	108
27211216802	HIV	184	108
27211216804	HIV	184	108
27211214102	JAMBHULWAD	184	108
27211203401	JARANDI	439	43
27211214201	JUNVANI	184	108
27211217701	KALAMBHE	184	108
27211215104	KALAMGAON	63	52
27211215103	KALAMGAON	184	108
27211215102	KALAMGAON	184	108

27211215101	KALAMGAON	184	108
27211205901	KALBHONDE	4120	3602
27211205902	KALBHONDE	4120	3602
27211206502	KAMBE	184	108
27211207804	KANADI	439	43
27211207801	KANADI	184	108
27211207803	KANADI	184	108
27211207802	KANADI	1451	244
27211207117	KASARA BUDRUK	439	43
27211207113	KASARA BUDRUK	439	43
27211207118	KASARA BUDRUK	439	43
27211207111	KASARA BUDRUK	439	43
27211207112	KASARA BUDRUK	439	43
27211207116	KASARA BUDRUK	794	179
27211207109	KASARA BUDRUK	794	179
27211207102	KASARA BUDRUK	794	179
27211207114	KASARA BUDRUK	794	179
27211207101	KASARA BUDRUK	794	179
27211207119	KASARA BUDRUK	794	179
27211207115	KASARA BUDRUK	171	86
27211207207	KASARA KHURD	439	43
27211207206	KASARA KHURD	601	507
27211207202	KASARA KHURD	794	179
27211207208	KASARA KHURD	794	179
27211207201	KASARA KHURD	794	179
27211207205	KASARA KHURD	184	108
27211203501	KASHTI	439	43
27211221601	KATBAV	439	43
27211216001	KAVADAS	184	108
27211204902	KHAIRE	1290	1311
27211204901	KHAIRE	1290	1311

27211208506	KHARADE	184	108
27211208501	KHARADE	184	108
27211208505	KHARADE	184	108
27211208503	KHARADE	184	108
27211208502	KHARADE	184	108
27211203605	KHARDI	108	225
27211203601	KHARDI	385	524
27211203602	KHARDI	184	108
27211216103	KHARIVALI (S)	541	987
27211216101	KHARIVALI (S)	184	108
27211216106	KHARIVALI (S)	184	108
27211216102	KHARIVALI (S)	184	108
27211209904	KHATIVALI	184	108
27211209906	KHATIVALI	184	108
27211209902	KHATIVALI	184	108
27211212901	KHOR	184	108
27211200401	KHOSTE	439	43
27211216201	KHUTADI	184	108
27211216901	KHUTGHAR	184	108
27211210801	KINHAVALI	28	15
27211212801	KOSHIMBADE	184	108
27211212802	KOSHIMBADE	184	108
27211214302	KOTHARE	439	43
27211214304	KOTHARE	184	108
27211214306	KOTHARE	184	108
27211214301	KOTHARE	184	108
27211202201	KUKAMBE	59	15
27211219201	KULHE	439	43
27211202402	LAHE	184	108
27211211802	LENAD BUDRUK	184	108
27211211702	LENAD KHURD	212	249
27211219301	LINGAYAT (VE. PADA)	184	108
27211207303	MAL	439	43
27211207301	MAL	439	43
27211207302	MAL	184	108
27211221201	MALEGAON	184	108
27211210101	MAMNOLI	439	43
27211220402	MANJARE	184	108
27211220403	MANJARE	184	108
27211220401	MANJARE	184	108
27211207403	MOKHAVANE	184	108
27211207404	MOKHAVANE	184	108
27211210903	MUGAON	281	74
27211219402	MUSAI	439	43
27211219401	MUSAI	1049	55
27211220002	NADGAON	439	43

27211220001	NADGAON	171	86
27211212206	NADGAON (LE.)	63	52
27211212201	NADGAON (LE.)	184	108
27211212202	NADGAON (LE.)	184	108
27211212203	NADGAON (LE.)	184	108
27211212207	NADGAON (LE.)	184	108
27211212204	NADGAON (LE.)	184	108
27211215201	NANDGAON (ATGAON)	184	108
27211208001	NANDGAON SO.	439	43
27211201701	NANDVAL	763	100
27211211903	NEHROLI	184	108
27211211902	NEHROLI	184	108
27211200601	NEVARE	258	367
27211206602	PACHGHAR	184	108
27211206601	PACHGHAR	184	108
27211222602	PALHERI	184	108
27211221701	PALI	184	108
27211215301	PALSHIN	184	108
27211215302	PALSHIN	184	108
27211209201	PARTOLI	184	108
27211210202	PASHANE	439	43
27211210201	PASHANE	184	108
27211222502	PATOL	5174	13
27211215401	PENDHARGHOL	184	108
27211215501	PENDHARI	244	108
27211203701	PIMPALPADA	184	108
27211222401	PINGALWADI	184	108
27211215601	PUNDHE	184	108
27211215602	PUNDHE	184	108
27211206104	RANVIHIR	2687	351
27211206102	RANVIHIR	439	43
27211206103	RANVIHIR	439	43
27211206105	RANVIHIR	184	108
27211212301	RAS	184	108
27211202501	RATANDHALE	651	391
27211206001	RODVAHAL	63	52
27211216401	SAJIVALI	184	108
27211216402	SAJIVALI	184	108
27211214404	SAKADBAV	184	108
27211214410	SAKADBAV	184	108
27211214402	SAKADBAV	184	108
27211214403	SAKADBAV	184	108
27211214408	SAKADBAV	184	108
27211215703	SAKHAROLI	439	43
27211213803	SAKURLI	184	108
27211213801	SAKURLI	184	108
27211213802	SAKURLI	184	108

27211217002	SAPGAON	184	108
27211205101	SARANGPURI	184	108
27211221903	SARMAL	439	43
27211221902	SARMAL	439	43
27211221901	SARMAL	184	108
27211219501	SATHGAON	184	108
27211217901	SAVROLI BUDRUK	641	594
27211213101	SAVROLI KHURD	51	13
27211208203	SAVROLI SO.	439	43
27211208204	SAVROLI SO.	439	43
27211208201	SAVROLI SO.	63	52
27211208205	SAVROLI SO.	184	108
27211208202	SAVROLI SO.	184	108
27211201802	SELAVALI (BAN.)	184	108
27211218015	SHAHAPUR	51	13
27211218004	SHAHAPUR	439	43
27211218011	SHAHAPUR	63	52
27211218006	SHAHAPUR	171	86
27211218012	SHAHAPUR	184	108
27211219103	SHEI	439	43
27211219101	SHEI	184	108
27211219601	SHENAVE	184	108
27211202603	SHENDEGAON	184	108
27211202601	SHENDEGAON	18	33
27211212102	SHENDRUN KHURD	150	616
27211219004	SHERE	439	43
27211219003	SHERE	439	43
27211219002	SHERE	291	44
27211211001	SHIL	184	108
27211211002	SHIL	184	108
27211205301	SHILOTTAR	184	108
27211201308	SHIROL	184	108
27211201315	SHIROL	184	108
27211201303	SHIROL	184	108
27211201305	SHIROL	184	108
27211201301	SHIROL	184	108
27211201306	SHIROL	184	108
27211201304	SHIROL	184	108
27211201309	SHIROL	184	108
27211201317	SHIROL	663	104
27211201316	SHIROL	663	104
27211201313	SHIROL	663	104
27211211203	SHIRVANJE	439	43
27211211201	SHIRVANJE	184	108

27211211101	SHIVAJINAGAR	1059	205
27211220102	SONGAON	439	43
27211220101	SONGAON	439	43
27211222701	SUSARWADI	184	108
27211200801	TAHARPUR	184	108
27211204401	TEMBHARE BUDRUK	184	108
27211204501	TEMBHARE KHURD	184	108
27211220501	TEMBHURLI	244	108
27211220507	TEMBHURLI	439	43
27211220505	TEMBHURLI	171	86
27211220503	TEMBHURLI	184	108
27211220502	TEMBHURLI	184	108
27211204301	THILE	184	108
27211221401	THUNE BUDRUK	268	38
27211221501	THUNE KHURD	184	108
27211216501	TUTE	184	108
27211202701	UMBERKHAND	184	108
27211202702	UMBERKHAND	184	108
27211207501	UMRAVANE	439	43
27211211301	VACHKOLE	439	43
27211218201	VALSHET	184	108
27211206802	VALSHET	184	108
27211206801	VALSHET	184	108
27211203801	VARASKOL	439	43
27211203802	VARASKOL	171	86
27211222801	VASHALE BUDRUK	184	108
27211222804	VASHALE BUDRUK	184	108
27211222901	VASHALE KHURD	63	52
27211222902	VASHALE KHURD	63	52
27211222009	VASHIND	496	642
27211222002	VASHIND	540	284
27211222003	VASHIND	496	642
27211222001	VASHIND	184	108
27211213402	VEDVAHAL	2369	24
27211213401	VEDVAHAL	63	52
27211210301	VEHLOLI (A.)	184	108
27211210302	VEHLOLI (A.)	184	108
27211219708	VEHLOLI BUDRUK	81	40
27211219704	VEHLOLI BUDRUK	439	43

27211219710	VEHLOLI BUDRUK	439	43
27211219709	VEHLOLI BUDRUK	184	108
27211219701	VEHLOLI BUDRUK	184	108
27211219703	VEHLOLI BUDRUK	184	108
27211219702	VEHLOLI BUDRUK	184	108
27211223001	VELUK	184	108
27211207605	VIHIGAON	439	43

Upper-primary/middle schools (only)

School code	Schools location	Distance from ST route (in meters)	Distance from road (in meters)
27211217201	AAWARE	184	108
27211218301	ABANRJE	63	52
27211201101	AJNUP	184	108
27211201401	ALYANI	184	108
27211216601	ANDAD	184	108
27211208602	APATE	184	108
27211217107	ASANGAON	858	537
27211217102	ASANGAON	244	108
27211217109	ASANGAON	235	79
27211217101	ASANGAON	184	108
27211201501	ASNOLI	67	11
27211209501	BHATSAI	184	108
27211209502	BHATSAI	30	10
27211202001	BIRWADI	95	32
27211217301	BORSHETI BUDRUK	184	108
27211212601	CHANDGAON	184	108
27211209601	CHANDROTI	184	108
27211220901	CHARIV	184	108
27211213901	CHILHAR	4422	157
27211209704	DAHAGAON	233	33
27211214901	DAHIGAON	184	108
27211204101	DAHIVALI	295	31
27211202901	DALKHAN	184	108
27211206301	DEHENE	184	108
27211220304	DHADHARE	184	108
27211222102	DHAKANE	184	108
27211204701	FARDEPADA SHIVNERI	184	108
27211222203	FUGALE	3629	172

27211205601	GANDULVAD	63	52
27211201601	GEGAON	439	43
27211203201	GOLBHAN	300	25
27211216801	HIV	184	108
27211214101	JAMBHULWAD	184	108
27211204201	KALGAON	171	86
27211217801	KAMBARE	439	43
27211208901	KANAVE	62	13
27211215001	KANVINDE	184	108
27211207104	KASARA BUDRUK	794	179
27211207105	KASARA BUDRUK	794	179
27211207203	KASARA KHURD	439	43
27211208507	KHARADE	184	108
27211208504	KHARADE	184	108
27211219901	KHARANGAN	439	43
27211203604	KHARDI	184	108
27211209001	KHARID	57	40
27211207901	KHARIVALI SO.	439	43
27211210804	KINHAVALI	67	90
27211210803	KINHAVALI	67	90
27211222301	KOTHALE	244	108
27211214303	KOTHARE	184	108
27211221001	KUDSHET	184	108
27211202401	LAHE	141	109
27211211801	LENAD BUDRUK	184	108
27211211701	LENAD KHURD	184	108
27211218801	MADH	184	108
27211210001	MAHULI	184	108
27211207304	MAL	2527	348
27211209101	MANEKHIND	439	43
27211218901	MASVANE	244	108
27211200502	MOHILI	792	81
27211200503	MOHILI	792	81
27211207402	MOKHAVANE	439	43
27211207401	MOKHAVANE	184	108
27211210901	MUGAON	184	108
27211221301	NARAYANGAON	184	108
27211222501	PATOL	184	108
27211213001	PIVALI	166	49
27211214405	SAKADBAV	184	108
27211214401	SAKADBAV	184	108
27211214406	SAKADBAV	184	108
27211215701	SAKHAROLI	439	43
27211221801	SANE	184	108
27211217001	SAPGAON	184	108

27211205102	SARANGPURI	184	108
27211216302	SARLAMBE	184	108
27211217902	SAVROLI BUDRUK	51	13
27211208206	SAVROLI SO.	51	13
27211201801	SELAVALI (BAN.)	623	113
27211218002	SHAHAPUR	439	43
27211218014	SHAHAPUR	75	17
27211218001	SHAHAPUR	184	108
27211218005	SHAHAPUR	239	109
27211205201	SHELAVALI (KH.)	184	108
27211212101	SHENDRUN KHURD	150	616
27211219001	SHERE	184	108
27211212401	SHIRGAON	180	5
27211201312	SHIROL	184	108
27211201302	SHIROL	184	108
27211201307	SHIROL	184	108
27211206201	TALVADE	184	108
27211215804	TEMBHE	542	158
27211220504	TEMBHURLI	439	43
27211221402	THUNE BUDRUK	268	38
27211209301	UMBHARAI	171	86
27211218101	VAFE	430	122
27211222802	VASHALE BUDRUK	184	108
27211222005	VASHIND	496	642
27211222011	VASHIND	496	642
27211210303	VEHLOLI (A.)	204	171
27211219706	VEHLOLI BUDRUK	184	108
27211213301	VEHLONDE	439	43
27211207602	VIHIGAON	2527	348

Secondary Schools (only)

School code	Schools location	Distance from ST route (in meters)	Distance from road (in meters)
27211200102	AGHAI	63	52
27211216602	ANDAD	2047	764
27211217111	ASANGAON	149	10
27211217103	ASANGAON	189	48
27211201502	ASNOLI	63	52
27211214502	ATGAON	63	52

27211216702	BAMANE	154	183
27211209503	BHATSAI	285	9
27211212602	CHANDGAON	258	282
27211209602	CHANDROTI	1379	1006
27211220902	CHARIV	106	95
27211213604	CHONDHE BUDRUK	63	52
27211214905	DAHIGAON	63	52
27211204103	DAHIVALI	540	284
27211202905	DALKHAN	63	52
27211204602	DHASAI	989	34
27211205502	DOLKHAMB	63	52
27211222204	FUGALE	3629	172
27211205602	GANDULVAD	63	52
27211207110	KASARA BUDRUK	964	20
27211207106	KASARA BUDRUK	1192	113
27211207107	KASARA BUDRUK	1192	113
27211208508	KHARADE	536	329
27211209002	KHARID	122	22
27211207902	KHARIVALI SO.	328	288
27211209903	KHATIVALI	198	1565
27211210805	KINHAVALI	67	90
27211214305	KOTHARE	63	52
27211219403	MUSAI	1049	55
27211201702	NANDVAL	163	76
27211214409	SAKADBAV	63	52
27211216303	SARLAMBE	63	52
27211218013	SHAHAPUR	395	112
27211218016	SHAHAPUR	171	86
27211219102	SHEI	80	82
27211202602	SHENDEGAON	63	52
27211222702	SUSARWADI	2475	22
27211215801	TEMBHE	2385	671
27211220506	TEMBHURLI	2655	76
27211204302	THILE	399	374
27211221502	THUNE KHURD	63	52
27211218102	VAFE	117	77
27211222805	VASHALE BUDRUK	63	52
27211222010	VASHIND	174	881
27211222006	VASHIND	218	916

27211210304	VEHLOLI (A.)	81	40

Higher secondary schools (only)

School code	Schools location	Distance from ST route (in meters)	Distance from road (in meters)
27211208604	APATE	63	52
27211217104	ASANGAON	189	48
27211205503	DOLKHAMB	103	93
27211203603	KHARDI	108	225
27211210802	KINHAVALI	196	48
27211212205	NADGAON (LE.)	47	38
27211215402	PENDHARGHOL	2371	2544
27211213004	PIVALI	370	118
27211213002	PIVALI	166	49
27211218010	SHAHAPUR	171	52
27211218007	SHAHAPUR	165	86
27211218008	SHAHAPUR	63	64
27211219603	SHENAVE	395	112
27211219602	SHENAVE	22	581
27211201310	SHIROL	663	104
27211200802	TAHARPUR	300	134
27211218103	VAFE	244	108
27211222007	VASHIND	540	284
27211222008	VASHIND	364	882

Distance of all Shahapur PHCs from ST route network and road network

PHCs location	Distance from ST route (in meters)	Distance from road (in meters)
Aghai	1967	1639
Apate	643	616
Dolkhamb	1239	585
Kinhavali	79	64
Shenawe	126	609
Shendrun	541	162
Tembha	1333	672

Bad Schools Catchment villages

School Code	School Location	Total villages served	Names of villages served
27211200502	MOHILI	8	Vaghivali, Nevare, Aghai, Vaveghar, Bhavse, Tanasa, Khoste, Dimbhe
27211202001	BIRWADI	7	Kukambhe, Birwadi, Sajivali, Shende, Pendharghol, Kashti, Palheri
27211207110	KASARA BUDRUK	8	Mokhavane, Mal, Vihigaon,Kasara Kh., Dand, Umbravane, Vashala Kh, Kasara Bk. (CT)
27211215801	TEMBHE	4	Belwad, Balwandi, Tembhe, Ambivali
27211222204	FUGALE	6	Fugale, Dhakane, Kothale, Kalbhonde, Roadvahal, Hinglud
27211222702	SUSARWADI	4	Vashala Bk, Veluk, Susarwadi, Pingalwadi
27211215402	PENDHARGHOL	4	Nandgaon, Pendhari, Sakharoli, Atgaon
27211205503	DOLKHAMB	17	Talwade, Chondhe Kh., Gandulwad, Chondhe Bk., Panchghar, Walshet, Gunde, Dehene, Kambe, Hedvali, Dolkhamb,Ranvihir, Kharade, Manjare, Bhinar, Sakurli, Malad

27211201310	SHIROL	21	Ajnup, Dapur, Shirol, Mokhavane, Mal, Vihigaon, Kasara Kh., Dand, Umbravane, Fugale, Vashala Bk, Vashala Kh, Veluk, Susarwadi, Pingalwadi, Dhakane, Kothale, Kalbhonde, Roadvahal, Hinglud, Kasara Bk. (CT)
27211213001	PIVALI	5	Piwali, Vehlonde, Savaroli Kh., Koshimbade, Khor
27211207602	VIHIGAON	2	Mal, Vihigaon
27211203603	KHARDI	27	Kalamgaon, Lahe, Kukambhe, Birwadi, Sajivali, Shende, Belwad, Balwandi, Tembhe, Ambivali, Dahigaon, Palshin, Dughar, Bendekon, Ghanepada, Pimpalpada, Varaskol, Jarandi, Dhamani, Golbhan, Umbarkhand, Ratandhale, Chande, Dalkhan, Kashti, Palheri, Khardi (CT) - Ward No.1
27211213002	PIVALI	5	Vehlonde, Savaroli Kh., Koshimbade, Piwali, Khor
27211204602	DHASAI	16	Patol, Kothare, Julawani, Sakadbav, Jambhulwad, Chilhar, Babare, Mangaon, Sarangpuri, Khaire, Shilottar, Kasagaon, Shelwali (Khadabachi), Dhasai, Mangaon, Shivaneri
27211209602	CHANDROTI	6	Mahuli, Awale, Karade, Chandroti, Mamnoli, Savaroli Bk.
27211220506	TEMBHURLI	3	Tembhurli, Dhadhare, Belwali

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