PROMOTION AND OUTREACH PROGRAM FOR BRT & NMT IN PCMC AREA

School Module on Sustainable Transportation

Facilitators' Guide
Draft

March 2014

IBI   CEE
                       Centre for Environment Education

Introduction

Under the GEF India Sustainable Urban Transport Program (SUTP) being implemented by the Ministry of Urban Development, Government of India, the Pimpri Chinchwad Municipal Corporation (PCMC) has accessed funds and is making a large investment in public transport in the form of the Bus Rapid Transit System (BRTS) and Non-Motorized Transport to provide access to the BRTS. These investments are expected to promote environmentally sustainable transport and reduce greenhouse gas emissions in the city. The project is being seen as a critical element among the solutions to address the mobility concerns of the city. A more accessible and friendly transport system will greatly contribute to improvement in the quality of life of the public.

One of the components of the SUTP is preparation of a detailed framework for promotion and outreach of the proposed Bus Rapid Transit System and Non-Motorized Transport Systems for Pimpri Chinchwad. The period of the project 'Promotion and Outreach Program' (POP) was 11 months; from 1 December 2013 to 31st October 2014.

As part of the project, a school outreach module was prepared and implemented in 15 schools in Pimpri Chinchwad.

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Module on Sustainble Transportation for Schools

Two versions of school sessions may be done, according to the time slot given by the school.
- For a one-hour slot, the session may consist of presentation on BRTS and discussion on do's and don'ts.
- For a half-day (four to five hour long) slot, a more detailed activity may be conducted, including an activity to understand the context of urban growth and transportation, followed by presentation on BRTS and discussion on do's and don'ts.

Process for one-hour school session
Schools are asked to identify a class or a single section of the class from either the 8th / 9th standard or the eco-club.

1. Introduction
The Facilitator initiates the session with questions about where the school is located, where in the city and how students / others in family travel

2. Understanding the need of PT and NMT through trends in Pimpri Chinchwad
To help students understand the probable causes for increasing travel need and demand, Facilitator shows figures for decadal population growth and growth in vehicular registration numbers in the city over the years. The futility of building flyovers and road widening may be explained. The importance of public transport as a long-term solution is to be discussed.

3. Rainbow BRTS
After showing pictures of the corridors and infrastructure under construction, the Facilitator may introduce Rainbow BRTS. Facilitator interacts with the students on specific aspects of their current experience of public transport use and introduced features one by one, such as safe crossing, level boarding, rapidity, passenger information etc.

4. Do's and Don'ts on travel modes, street use, etc
The focus of this segment of the session is on practices of road use, parking, travel modes and vehicle modes, discussing do's and don'ts. This may be done as a quiz and the answers for each discussed to bring out the rationale for why such behaviour may be good or may need to be changed:
- I cross roads using the zebra crossings.
- When we travel by car or bus I do not like people walking or coming on bicycles blocking our way.
- I use my bicycle every day to go to school.
- I requested Principal Madam to remove the bicycle stand and make more parking for bikes and cars.
- I use my bicycle to go to playground, tuition class or friends home.
- We did a project on walkability assessment of footpaths near school and home and wrote to ward office to repair it and remove obstacles.

Process for half-day school session
Schools are asked to identify a group of 40 to 60 students, from either the 8th / 9th standard or the eco-club. The initial session is done with this group.

1. Introduction
The Facilitator initiates the session with questions on where is the school located, where do students / others in family travel and how
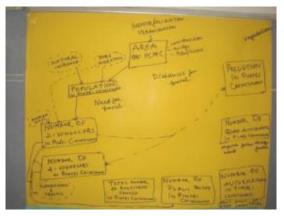
2. Understanding trends in Pimpri Chinchwad
This activity is done in sub-groups. Each sub-group is provided activity sheets containing data on trends of growth of the urban area, population, vehicle numbers, accidents, etc. Students are asked to represent the data provided as graphs.

The graphs prepared by each sub-group are pasted onto chart paper which they then use to present their understanding and perceptions about the trends observed, to the other sub-groups.

3. Need for PT and NMT
The Facilitator then brings together the students' discussions as a mind map and draws attention to the need for public transport, and improved facilities for NMT.

For the next segment of the session, the students' chart paper presentations are photographed and inserted into a slide show. These students (or the Facilitator if time is short) then present the slide show to a larger group of students, such as the other divisions or the rest of the middle school.

4. Do's and Don'ts on travel modes, street use, etc

The Facilitator quizzes the larger group on practices of road use, parking, travel modes and vehicle modes, discussing do's and don'ts, such as:

- My family and I take the bus when we go to market or to watch film
- When we travel by vehicle we stop it on Zebra Crossings
- I insist my father to follow traffic signals and rules while driving
- Last time we went to market we parked our vehicle on footpath
- We did a project on walkability assessment of footpaths near school and home and wrote to the municipal ward office to repair it and remove obstacles
- I cross roads using the zebra crossings
- When we travel by car or bus I do not like people walking or coming on bicycles blocking our way
- I use my bicycle every day to go to school
- I requested Principal Madam to remove the bicycle stand and make more parking for bikes and cars.
- I use my bicycle to go to playground, tuition class or friends home.
- I listen to songs and use my mobile while driving, cycling or walking on road

5. Rainbow BRTS

The final segment of the session is about BRTS. After showing pictures of the under construction corridors and infrastructure, the Facilitator introduces Rainbow BRTS. She interacts with the students on specific aspects of their current experience of public transport use and introduces features one by one, such as safe crossing, level boarding, rapid, passenger information etc.

The set of charts created by the students are left with the school for display. Once BRTS poster exhibits are ready, a set will be sent to each of these schools.

The response from students and teachers has been enthusiastic. Teachers often help the students prepare and present their graphs and points. Students have adequate opportunity for interaction with the CEE IBI resource persons and discussion among themselves which helps to enhance their understanding about transportation issues.

Requirements for the session

For Facilitator
- Equipment – Projector, Lap top (with both the copies of presentations), a pen drive, camera, camera cable (to transfer pictures), video camera, video camera cable (charged).
- Forms – Feedback forms for students, Feedback forms for teachers, School Enrolment Form
- Stationery – Chart papers (10 for each school), marker pens (5), sketch pen sets (7), pencils (10), rubber (10), sharpeners (10), scales (10), cello tape (transparent), and scissor (4), Pen (10 packets), fevicol (5).
- Graph activity – Graph paper (a bundle), work sheets (2 copies), blank papers (a bundle),
- Exhibits - Prepared exhibits (4), stickers for 2 wheelers, 4 wheelers, buses and autos.
- Presentations –
    i.   School template presentation
    ii. BRTS presentation

From School
- Time of 4 – 4:30 hours
- Students
    - For initial 3 hours – 40 (class 8th preferably)
    - For last 1 – 1:30 hour – Along with initial 40 students more students ranging from 60 to 100 (could be of other sections of class 8th or even class 9th or 10th.) This number could be made as per the capacity of the hall/room.
- One room / two rooms where
    - About 40 students can be made to sit on floor and make graphs in group of 5.
    - Apart from these 40 students, more 60 – 100 students can be made to sit, for second half of the module
    - Projector can be put up and presentation can be made.
- If possible, a white board (with markers and duster) or a black board (with chalks and duster).

Schedule

S. No.	ACTIVITY	Time
1	**Introduction** Session will start by giving introduction on - Brief background for the session - Why do we need to travel? - Are 'Environment' and 'Transport' linked?	15 minutes
2	**Pictorial Illustrations** Students will be asked following questions to build up their basic understanding. **1. Who Travels** - On a chart paper or white/black board, write in big caps letter – WHO, - Encircle it and - On outward radiating arrows write various answers given by students – students, teachers, professionals, parents, elderly, disabled etc. - Take a picture of it. **2. How do you Travel** - On a chart paper or white/black board, write in big caps letter – HOW, - Encircle it and - On outward radiating arrows write various answers given by students – bike, car, bus, auto, cycle, walk etc. - Take a picture of it. **3. Where do you Travel** - On a chart paper, write in big caps letter – WHERE, - Encircle it and - On outward radiating arrows write various answers given by students – school, college, office, garden, temple, hospital, railway station etc. - Take a picture of it.	15 minutes
3	**Graph Activity**	60 minutes
	Illustration for graph activity - Start the activity with a question - Pimpri Chinchwad city is growing. How can you say that? Take comments. - Facilitate their answers by saying can we say this based on some of the indicators which can be measured ex. population, area of the city, number of 2 wheelers or 4 wheelers etc. - After this question and answer interaction, tell students that to see how our city and vehicle use are growing they would be given some data to study and prepare graphs for each of the variables. - Make 8 – 9 groups each comprising of 4-5 students each. (the number of groups and students in each group can vary from school to school depending upon the number of students provided by school for initial activity) - Make them sit in groups. Each group will form a closed circle and will sit little away from other groups. - To each group, give a data sheet, a graph paper and stationery material required to plot the graph. - A common illustration followed by individual group wise illustrations on how to proceed in the activity should be given.	

	- Tell the groups –
	    o Take a look at the data given to you
	    o Check if they know how to make graphs and explain briefly
	    o Read the instructions on the worksheets given for preparing the graphs
	    o Also read the discussion points in relation to the data given which is for interpreting the graph, discussing within the group and noting down the points on a blank paper for presentation later.
	    o In the later part of the session, power point presentation will be made from their output of the activity and that each group would present the same to larger group of students.
	    o Tell students how much time they have for the activity (45 minutes)
	Once they start, they will be continuously facilitated.
	Provide
	• Sketch pens to each group to outline the axes, bars and colour the bars so that it is visible from a distance
	• Chart paper or to each of the group to note down their discussion points. Interpretation of their data
	
	Photo document the process and the charts from each group. These pictures will be inserted in the school template presentation for the next part of the module.
	After the graph plotting exercise and before presentation of exhibits, common announcement shall be made stating that -
	- Each group has to present their graph and points of discussion to the rest of the students.
	- They can divide the content among themselves. Each one of them in a group has to speak up in the presentation.
	- They shall be asked to nominate a monitor among themselves who will stick their group graph on exhibit with a facilitator.
	After they are done with their graphs and points of discussion, group monitor will stick their graphs on appropriate exhibits. Exhibits and respective graphs will be as follows:
	1. Growth of Pimpri Chinchwad – Graphs for area and population.
	2. Vehicular registrations in Pimpri Chinchwad – Graphs for number of 2 wheelers, 4 wheelers, total registered vehicles, autorickshaws.
	3. Negative impacts of current transportation pattern in Pimpri Chinchwad – Graphs for number of road accidents and pollution levels.
	4. Status of Public Transport in Pimpri Chinchwad – Graphs for number of Public Buses.	

4	Mind maps and group presentation by students After the plotting activity, presentation from students will begin – - Each group will come at front, will hold the exhibit of their graph to show it to other students and will start presentation by introducing their group, graph they were given and will illustrate their graph with reference to points of discussion. - Simultaneously, facilitator will make the mind map based on the points stated by students {(either on the board or on chart paper). - Audience students shall be encouraged to ask questions to the	45 minutes

	presenting group and vice versa i.e. presenting group will ask questions to audience group. This is just to garner involvement of each one of them and to make whole presentation activity interactive. - After each group presents, facilitator will add points and description on each of the graph. - Students shall be asked for their queries. Once all the groups are done with their presentations, mind map will be shown to them to reflect their overall understanding. Facilitator will explain them each variable with the help of mind map and possible inter linkages among variables.	
5	LUNCH - While students break for lunch, prepare the school presentation by inserting pictures and graphs at respective slides. - Their school location will also be inserted on the corridor map of PCMC in a slide (by insert symbol) and filling up the symbol to show them location of their school w.r.t. BRTS corridors. Students can be asked – near which corridor does your school lie?	30 minutes
	The 2nd half of the session will start with both the groups i.e. the initial smaller group of around 40 students and other larger group which could involve rest of the sections of the same class (8th) or other classes as well (9th / 10th).	
6	FACILITATOR /STUDENT PRESENTATION ON THEIR ACTIVITY Facilitator/students will present the template presentation to all the students, which will illustrate the earlier activity with details done by their class mates in the session and what the purpose was behind.	30 minutes
7	FACILITATOR PRESENTATION ON BRTS This presentation will be followed by BRTS presentation.	30 minutes
8	FILLING UP OF FEEDBACK FORMS Both the groups of students will be made to fill the feedback forms. Facilitator will help them to fill the forms.	20 minutes

Support Facilitators' Role
   a. Documentation of questions asked by students and faculty
   b. Clicking pictures
      ▪ Who, How, Where
      ▪ Of each graph
      ▪ Mind Map
      ▪ Student activities – graph plotting, asking questions/giving answers, presenting exhibits, filling up feedback forms, students listening to facilitator presentation.
   c. Video recording of the whole session.
   d. Get school enrolment form filled by school authority.
   e. Count exact number of students in each group with number of girls and boys.

ACTIVITY - Understanding Trends of Urbanization and Transportation in our City

Objectives

- Help students understand trends related to urbanization and transportation in their city
- Develop the students' competency to interpret data and represent them graphically
- Develop the students' systemic thinking competence

Level: Standards 7 to 10

Duration: 30 minutes

Related Subjects: Geography, Mathematics, Language, Life Skill

Materials: Writing materials, chart paper, sketch pens, worksheets, graph papers, map of PCMC (showing old and new boundaries)

Method

1. Divide the students into groups of 4 to 6.
2. Give each group one worksheet with the data sets to draw the graphs (worksheet 1 to 9 attached).
3. Explain how to plot graphs, analyze the data and present their observations.
4. Each group is to present their observations using the graphs they have made.
5. Initiate short discussions on the points observed by them and how these factors are linked to city growth and transportation; draw a mind map adding relevant points from each group presentation. After all groups have presented, consolidate the discussion using the mind map.
6. The students' graphs may be photographed and made into a slide show, or put up as a poster exhibition for the rest of the school to see.

Worksheet - 1

Municipal Area of Pimpri Chinchwad over the years

The state government declares the jurisdiction of municipal authorities. The municipal area is the area the urban local body or municipality is constituted of and is responsible to plan, manage and provide the civic services.

Table: **Data of municipal areas of PCMC over the years**

Year	Area of PCMC (sq km)
1982	86
1997	170
2007	181

Procedure
1. Plot a bar graph using the figures of Pimpri Chinchwad Municipal Corporation (PCMC) city area given as municipal limit in the past years. This is the area declared under the jurisdiction of PCMC in different years.
2. Take a map of PCMC showing the old and new boundaries. Colour the areas with different colours showing expansion of the city time to time.

Points for discussion
1. What do you understand from the data, the maps and the graph? What change has taken place in the municipal area of PCMC in the past few decades?
2. What could be the reasons for this change?
3. What may be the effect on our city, and on civic services like public transportation services?
4. What will happen if it continues like this?

To plot the graph
   1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper using a scale.
   - Label X axis as 'Years' and Y as 'Municipal Area of PCMC (in sq km)'
   - Mark the intervals as scale on both the axis on graph paper such as 1982, 1997 and 2007 on X axis representing 'Years.' Similarly, mark 'Area' on Y axis, as scale starting from 50, 60, 70, … and so on till 200 at an interval of 1 cm = 10 sqkm.
   - Draw a bar graph for the given values of the area on that year.
   - Write title of the graph as 'Municipal Area of PCMC.'

Worksheet - 2

Population of PCMC Area

The population of a city, state or country is counted at an interval of 10 years (every decade) that is in the first year of the decade, in a Census survey. Population data is used in preparing and implementing plans for the management of the city, for the welfare of citizens and the environment.

Table: **Population of Pimpri-Chinchwad City**

Year (Census data)	Population of PCMC (approx. in Lakhs)
1951	0.26
1961	0.40
1971	0.99
1981	2.52
1991	5.21
2001	10.06
2011	15.07
2021	21.50 (estimated)
2031	29.08 (estimated)

Procedure
1. Plot a bar graph using the figures given for the population of PCMC over the years. This is the population counted in the first year of each decade.
2. Discuss in your group the trend of population of the city over the decades; note down the main points of your discussion in your notebook.

Points for discussion
1. What kind of change do you see in the population of PCMC? What does the graph indicates?
2. What could be the reasons for this change in the population of city?
3. What may be the effects of such a change in population on our city and urban transport?
4. What will happen if this continues as per the estimated figures?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Years' and Y axis as 'Population of PCMC (in Lakhs)'
   - Mark the intervals as scale on both the axis on graph paper such as on X axis 1951, 1961, … 2011, … and so on at an interval of 1 cm representing 'Year' of the decades. Similarly, mark 'Population' on Y axis, as scale starting from 0, 2, 4, … and so on till 30 at an interval of 1 cm.
   - Draw bar graphs for the given values of the population at the year of the decade. Draw a line to understand the trend of population in PCMC. Write title of the graph as 'Population of PCMC.'

Worksheet – 3

Number of registered four-wheelers in Pimpri-Chinchwad City

The Regional Transport Office (RTO) registers the motor vehicles purchased in the area under its jurisdiction. The vehicles registered by the RTO of PCMC have the registration number starting from MH-14. The vehicles having the registration number/number plate of MH 14 series are registered in Pimpri Chinchwad.

Table: **Registered Four-wheelers in Pimpri-Chinchwad City**

Year	Number of Registered 4-Wheelers in PCMC (in thousands)
2002	28
2003	30
2004	35
2005	42
2006	50
2007	60

Procedure
1. Plot a bar graph using the figures given for the number of registered 4-wheelers in PCMC. This is the total number of registered 4-wheelers in the city in that year.
2. Discuss in your group the trend of 4-wheelers number in PCMC and note down in your notebook.

Points for discussion
1. What do you understand from the graph of 4-wheelers registered in PCMC?
2. What could be the reason of this trend seen in 4-wheelers registration?
3. What may be the effects of such a trend in 4-wheelers numbers on our city?
4. What will happen if this trend continues in the future?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of Registered 4-Wheelers in PCMC.'
   - Mark the intervals as scale on both axis on graph paper. Such as on X axis 2002, 2003 and so on till 2007 at an interval of 1 cm representing 'Year'. Similarly, mark 'Number of Registered 4-Wheelers' on Y axis, as scale starting from 20, 24, 28, 32, … and so on till 64 (in thousands) at an interval of 1 cm = 4 thousand.
   - Draw bar graph for the given figures of registered 4-wheelers in that year. A line can also be drawn to show the trend in 4-wheelers number.
   - Write title of the graph as 'Registered Four-Wheelers in PCMC.'

Number of registered two-wheelers in Pimpri-Chinchwad City

The Regional Transport Office (RTO) registers the motor vehicles purchased in the area under its jurisdiction. The vehicles registered by the RTO of PCMC have the registration number starting from MH-14. The vehicles having the registration number/number plate of MH 14 series are registered in Pimpri Chinchwad.

Table: **Registered Two-wheelers in Pimpri-Chinchwad City**

Year	Number of Registered 2-Wheelers in PCMC (in thousands)
2002	212
2003	236
2004	271
2005	309
2006	352
2007	396

Procedure
1. Plot a bar graph using the figures given for the number of registered 2-wheelers in PCMC. This is the total number of registered 2-wheelers in the city in that year.
2. Discuss in group the trend of 2-wheelers number in PCMC and note down in your notebook.

Points for discussion
1. What do you observe looking at the graph of total number of registered 2-wheelers in PCMC?
2. What could be the reasons behind this trend seen in 2-wheelers registration?
3. What may be the effects of such a trend in 2-wheelers registration on our city?
4. What will happen if this trend continues in the future?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of Registered 2-Wheelers in PCMC.'
   - Mark the intervals as scale on the axis on graph paper such as on X axis 2002, 2003 and so on till 2007 at an interval of 1 cm representing 'Year'. Similarly, mark 'Number of Registered 2-Wheelers' on Y axis, as scale starting from 200, 210, 220, … and so on till 400 at an interval of 1 cm = 10.
   - Draw bar graph using the given figures of registered 2-wheelers in PCMC. A line can also be drawn to see the trend.
   - Write title of the graph as 'Registered Two-Wheelers in PCMC.'

Worksheet - 5

Number of registered vehicles in Pimpri-Chinchwad City

This includes the two wheelers, auto, cars/light motor vehicles (LMV), heavy motor vehicles (HMV) and other private and commercial vehicles like ambulance, delivery vans, school bus and tractors.

The Regional Transport Office (RTO) registers the motor vehicles purchased in the area. The vehicles registered by the RTO of PCMC have the registration number starting from MH-14. The vehicles having the registration number/number plate of MH 14 series are registered in Pimpri Chinchwad.

Table: **Total Registered Vehicles in Pimpri-Chinchwad City**

Year	Number of Registered Vehicles in PCMC (in lakhs)
2002	2.69
2003	2.97
2004	3.40
2005	3.88
2006	4.45
2007	5.03

Procedure
1. Plot a bar graph using the figures given for the total number of registered vehicles in PCMC.
2. Discuss in group the trend of number of vehicles in PCMC and note down in your notebook.

Points for discussion
1. What do you observe looking at the graph of total number of registered vehicles in PCMC?
2. What could be the reasons behind this trend seen in vehicle ownership?
3. What may be the effects of such a trend in number of vehicles on our city?
4. What will happen if this trend continues in future?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of Total Registered Vehicles in PCMC.'
   - Mark the intervals on both axis on graph paper such as on X axis, 2002, 2003 and so on till 2007 at an interval of 1 cm representing 'Year'. Similarly, mark 'Number of Registered Vehicles' on Y axis, as scale starting from 2.00, 2.50, 3.00, 3.50… and so on till 6.00 at an interval of 1 cm.
   - Draw bar graphs using the given figures of registered vehicles in PCMC. A line can also be drawn to see the trend.
   - Write title of the graph as 'Number of Total Registered Vehicles in PCMC.'

Worksheet - 6

Public Transportation System - number of public transport buses operating on road

Pune Mahanagar Parivahan Mahamandal Limited (PMPML) is the company which provides the public transport services to the citizens of Pimpri Chinchwad and Pune. The number of buses operating on road on a daily basis is lesser than the total buses in its fleet due to breakdowns.

Table: **Public Transport Buses in PMPML fleet and buses operating on road in PCMC City**

Year	Number of Public Transport (PT) Buses	Number of PT Buses on Road in PCMC
2001-02	239	121
2002-03	239	111
2003-04	112	117
2004-05	112	123
2005-06	288	169
2006-07	267	160
2007-08	250	148
2008-09	283	188
2009-10	319	232
2010-11	344	258
2011-12	347	253
2012-13	389	287
2013-14	411	312
Source: PMPML		

Procedure
1. Plot a bar graph using the figures given for 'number of public transport buses on road in PCMC.' This is the average number of buses operated on a daily basis in the PCMC city limit by PMPML.
2. Compare the 'total buses' with 'number of buses on road.' Discuss in your group the importance of public transport buses and that they remain in operation. Note down the main points of your discussion in your notebook.

Points for discussion
1. What do you observe regarding the public transport buses running in PCMC from the graph?
2. What could be the reasons behind the trend seen? And what does this indicate?
3. What may be the effects of such a trend on the city and urban transport?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of PT Buses on Road'
   - Mark the intervals on both axes on graph paper. Such as on X axis 2001-02, 2002-03 and so on till 2013-14 at an interval of 1 cm representing 'Year'. Similarly, mark 'No. of PT Buses on Road' on Y axis, from 100, 120, 140, … and so on till 360 at an interval of 1 cm.
   - Draw bar graph for the given numbers of buses on road in that year.
   - Write title of the graph as 'Number of Public Transport Buses on Road in PCMC.'

Worksheet - 7

Number of Auto-rickshaws in PCMC

Intermediary public transits (IPTs) are modes like auto-rickshaws, 6 seaters, etc that operate or are used for short or medium distances. They are usually self-organized, privately operated and partially regulated. Often when there is a lack of public transport buses, then auto rickshaws and six-seater rickshaws are also used for longer distance travel though it may be more expensive. Most of the auto-rickshaws that run in PCMC are 6 to 8 seater types, and are shared by passengers along fixed routes.

Table: **Auto-rickshaws operating in PCMC area as IPT**

Year	Number of Auto Rickshaws in PCMC
2002	5300
2003	5400
2004	5600
2005	6100
2006	6500
2007	6700

Procedure
1. Plot a bar graph using the figures given for the number of Auto-rickshaws operating in PCMC area.
2. Discuss in your group what does this indicate regarding the urban transportation and public transport in the city and note down in your notebook.

Points for discussion
1. What do you observe regarding the Auto-rickshaws in PCMC from the graph?
2. What could be the reasons behind this? And what does this indicate?
3. What may be the effects of this trend on the city and urban transport?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of Auto-rickshaws'
   - Mark the intervals on both axes on graph paper such as on X axis, 2002, 2003, 2004 and so on till 2007 at an interval of 1 cm representing 'Year'. Similarly, mark 'No. of Auto-rickshaws' on Y axis, as scale starting from 5000, 5100, 5200, … and so on till 7000 at an interval of 1 cm.
   - Draw bar graph for the given number of Auto-rickshaws in PCMC in that year.
   - Write title of the graph as 'Number of Auto-rickshaws operating in PCMC.'

Traffic Safety - road accidents in PCMC

Studies show that the increasing number of motorized vehicles causes increase in the number of road accidents due to the higher speed of automobiles and their dominance on the road. Also the most vulnerable of these road accidents are the pedestrians and cyclists due to lack of on road safety measures for them.

Table: **Road accidents and fatal road accidents in PCMC**

Year	Number of road accidents in PCMC	Number of Deaths
2000	219	118
2001	187	100
2002	153	102
2003	182	119
2004	252	135
2005	241	147
2006	266	158
Until Oct 2007	277	157

Procedure
1. Plot a bar graph using the figures given for the numbers of road accident occurred in PCMC limit and the number of deaths in these accidents. These are the combined numbers for fetal and major accidents and the number of people died as per police records in the road accidents due to traffic every year in PCMC area only.
2. Discuss in your group why this happens and note down in your notebook.

Points for discussion
1. What can you observe from the graph of road accidents in PCMC area?
2. Who could be those affected in these accidents?
3. What could be the reasons for the road accidents?
4. What is the acceptable number of accidents according to your group?

Hints for plotting the graph
1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Number of Road Accidents and Deaths'
   - Mark intervals as scale on both the axis on graph paper such as on X axis, 2000, 2001 and so on till 2007 at an interval of 1 cm representing 'Year'. Similarly, mark 'No. of Accidents and Deaths' on Y axis, as scale starting from 100, 110, 120, … and so on till 300 at an interval of 1 cm.
   - Draw bar graphs for the given figures of Road Accidents and Deaths happened in PCMC. Use different colours for 'Road Accidents' and 'Deaths.' You can also draw line graphs to get a trend.
   - Write title of the graph as 'Road Accidents and Deaths in PCMC.'

Worksheet - 9

Air Quality of Pimpri-Chinchwad City

The Maharashtra Pollution Control Board (MPCB) monitors the air quality of PCMC area. MPCB has installed an air quality monitoring station on the PCMC building. The air pollution measured here is in terms of the concentration of the pollutants present in the air such as sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and respirable suspended particulate matter (RSPM). This monitoring station comes under the residential area. The major source of air pollutants in an urban residential area is generally vehicular emissions.

Table: **Data of Air Pollution monitored in Pimpri-Chinchwad City**

Year	Annual Average Concentration of Air Pollutants (in $\mu g/m^3$)		
	SO_2	NO_2	RSPM
Standards	50	40	60
2005	20	35	92
2006	24	41	127
2007	21	46	106
2008	22	35	95
2009	25	43	92
2010	30	42	83
2011	33	62	113
2012	22	48	93
2013	21	43	85

The air quality measured needs to be compared with the national air quality standards prescribed by the Central Pollution Control Board (CPCB). It should be within the limit of the standards for keeping the air quality safe for people. If the concentration of pollutants exceeds the concentration given in the standards for residential areas, then action needs to be taken to control air pollution and improve quality of the air for better quality of life and health of people.

Procedure
1. Plot a graph using the figures given for the air pollution in Pimpri-Chinchwad city. This is the annual average concentration of air pollutants measured at Pimpri-Chinchwad Air Quality Monitoring Station installed at the PCMC building.
2. Compare the data of pollutants concentration with the air quality standards prescribed and highlight the rows / years in which the concentration of pollutants was worse than the standards.
3. Discuss in group the trends, violation of limits, your reasoning for causes and impacts. Note down the main points of your discussion in your notebook.

Points for discussion
1. What do you understand looking at the graph of air quality in Pimpri-Chinchwad?
2. What could be the reasons behind this level of pollution measured in PCMC area?
3. What could be the effects of this level of air pollution on the health of people in the city?
4. What will happen if the trend remains the same in future?

Hints for plotting the graph

1. Steps to plot the graph
   - Draw the X axis and Y axis on the graph paper with a scale.
   - Label X axis as 'Year' and Y axis as 'Concentrations of Air Pollutants (**in** $\mu g/m^3$).'
   - Mark the intervals on both the axis on graph paper. Such as on X axis, 2005, 2006, 2007, … and so on till 2013 at an interval of 1 cm representing 'Years'. Similarly, mark 'Conc. of air pollutants (in $\mu g/m^3$)' on Y axis, as scale starting from 10, 20, 30, … and so on till 140 at an interval of 1 cm.
   - Mark the dots on graph paper as per the figures of SO_2 Conc. every year. Now join these dots with straight lines to obtain a line graph. You can write the figures also.
   - Similarly, put the dots on the graph paper corresponding to the figures of NO_2 Conc. every year and join them using a pen of a different colour to obtain a line graph. Repeat the similar procedure for the RSPM Conc. and draw the graph for the same. Drawing the graphs with different colours and writing the figures on it. It helps in understanding graph easily. Make a legend showing which colour indicates which parameter.
   - The figures which are above the standard can be written in red colour.
   - You can also draw bar graph using the given figures for the air pollutant concentrations.
   - Write the title of the graph as 'Air Quality in Pimpri-Chinchwad.'