

**Scope of Work**  
for  
**After Study – Traffic Data Collection and Analysis**  
For the Research Study on  
**Advanced Traveller Information System (ATIS) for Indian Cities**

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## **1.0 BACKGROUND**

Advanced Traveller information system (ATIS) are a subset of Intelligent Transportation Systems (ITS) that provides travelers with travel related information using advanced techniques in traffic sensing, information processing, system control and modern communication media to provide personalized, reliable and timely information to the service users.

Any ATIS implementation is expected to reduce the travel time and delays, improve stream speed and reduce congestion. For the evaluation of the success of any ATIS implementation, a thorough impact analysis needs to be carried out. For such an analysis, *before* and *after* data on traffic parameters such as stream speed, travel time, delays, volume etc. need to be collected.

The Transportation Engineering Division, Dept. of Civil Engineering., Indian Institute of Technology (IIT) Madras, is conducting a research project on “ATIS for Indian Cities”, sponsored by the Department of Electronics and Information Technology (DeitY), Government of India, and as part of the impact analysis of the project, there is a need to carry out a detailed *before* and *after* analysis. In this connection, services of an external agency are required to carry out the surveys to collect and analyze (as described in Section 2) *after study* data.

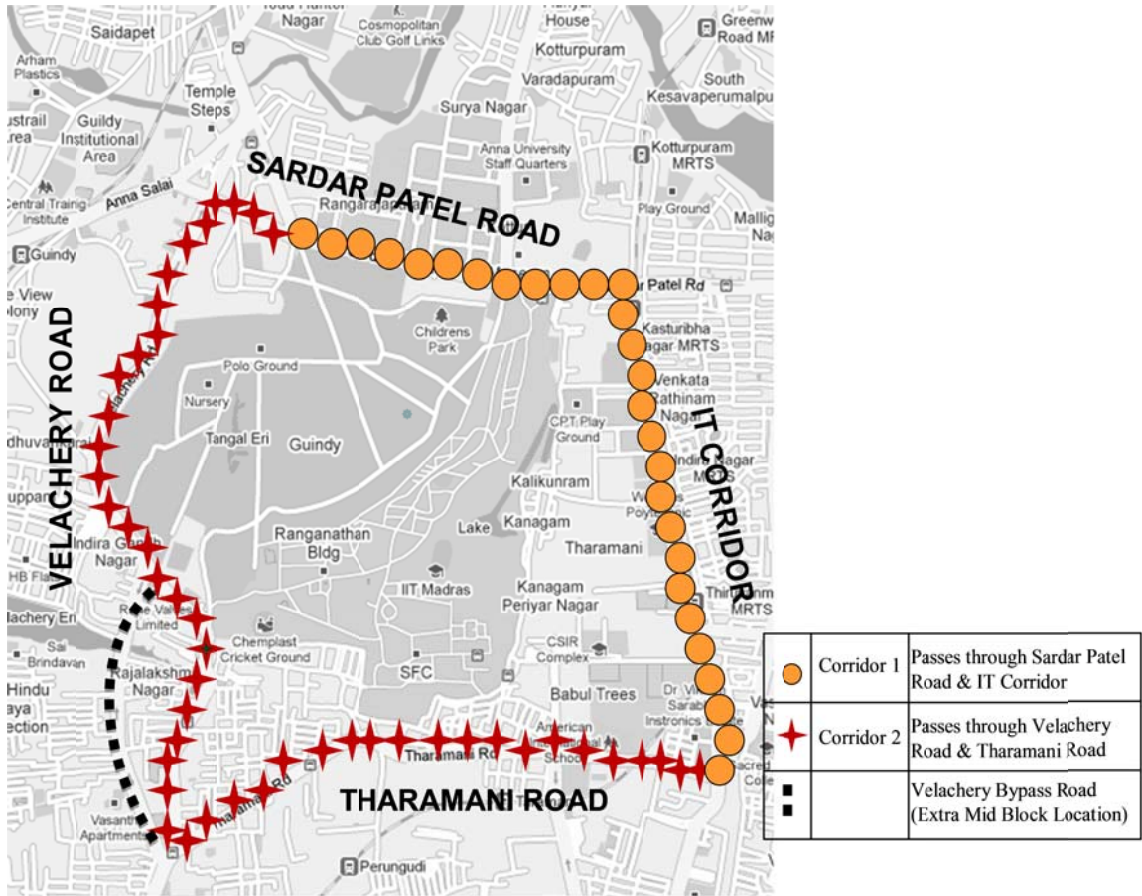
### **1.1 Site Details**

The site chosen for implementation of the project is near IIT Madras located on Chennai's Sardar Patel Road, flanked by the residential districts of Adyar and Velachery. The study area comprises two alternative corridors (shown in Figure1) as detailed below,

- 1 First corridor includes **Sardar Patel road and IT corridor** (Approx. 6 km)
- 2 Second corridor includes **Velachery road and Tharamani road** (Approx. 9 km)

The details of these corridors showing intersections and midblock sections are given in Figures 2 and 3.

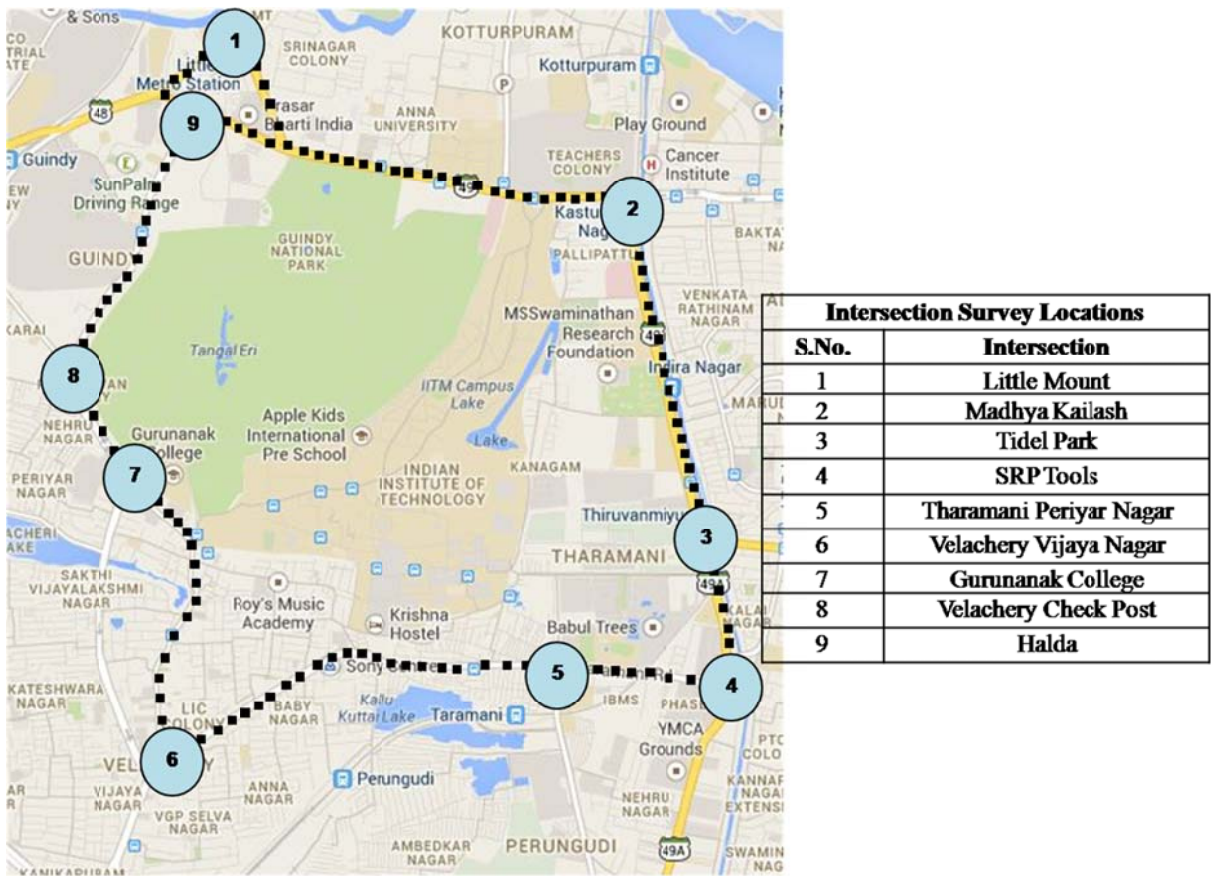
The approach road names and the type of intersection (3 legged or 4 legged) are listed in Table 1.



**FIGURE 1 Study Area Showing the Project Corridor**

**TABLE 1 Intersection Details**

<b>SL.NO</b>	<b>INTERSECTION NAME</b>	<b>NO. OF APPROACHES</b>	<b>ROAD NAME</b>
1	Little Mount	4	1. Anna Salai (Mount Road) 2. Anna Salai (Mount Road) 3. Velachery Road 4. Taluk Office Road
2	Madhya Kailash	3	1. Sardar Patel Road 2. Sardar Patel Road 3. Canal Bank Road (West)
3	Tidel Park	3	1. Canal Bank Road (West) 2. Canal Bank Road (West) 3. West Avenue Road
4	SRP Tools	3	1. Canal Bank Road (West) 2. Lattice Bridge Road 3. Tharamani Road
4	Taramani Periyar Nagar	3	1. Tharamani Road 2. MGR Main Road 3. Tharamani Road
6	Velachery Vijaya Nagar	3	1. Velachery Main Road 2. Tharamani Road 3. Velachery Main Road
7	Gurunanak College	3	1. Velachery Main Road 2. Velachery Bypass Road 3. Velachery Main Road
8	Velachery Check Post	3	1. Velachery Main Road 2. Velachery Main Road 3. Guindy Race Course Salai
9	Halda	4	1. Velachery Main Road 2. Sardar Patel Road 3. Velachery Main Road 4. Sardar Patel Road



**FIGURE 2 Intersection Locations along the Project Study Area**

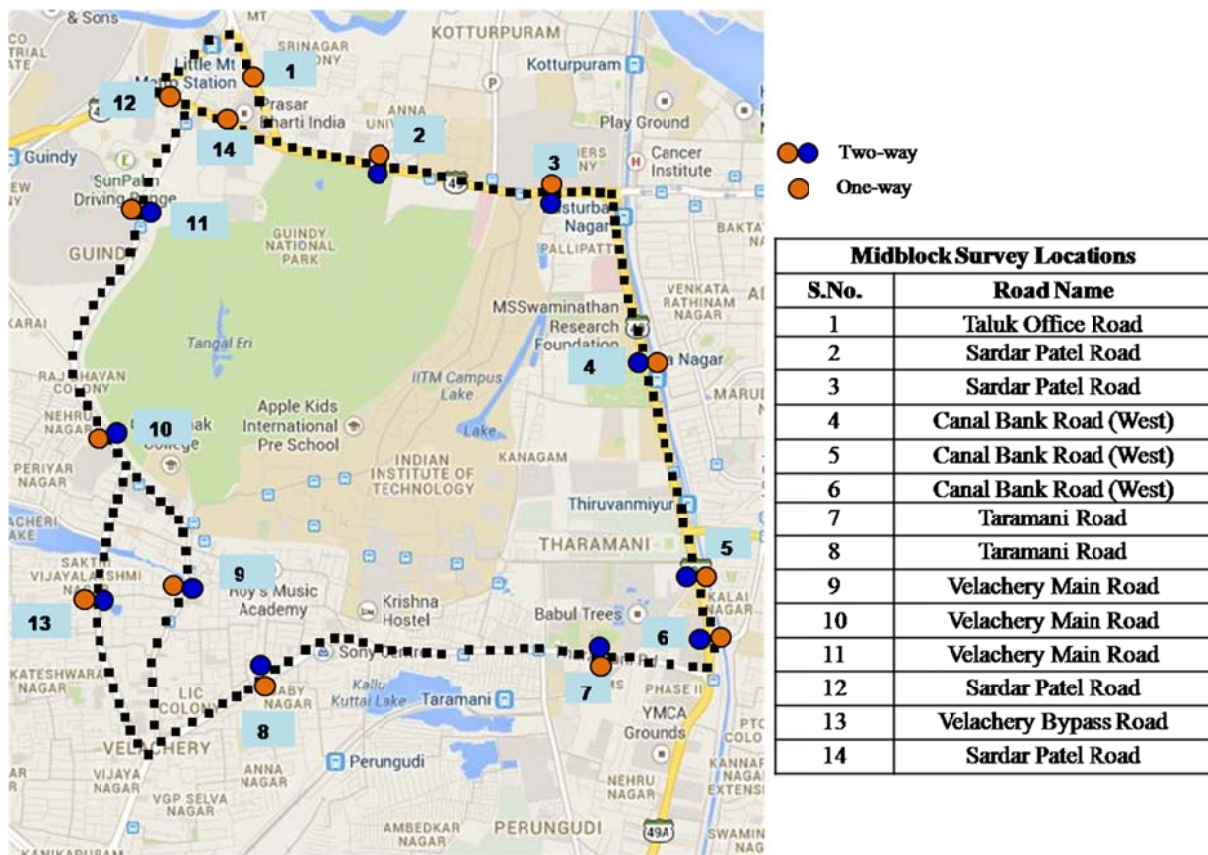


FIGURE 3 Mid-block Sections on the Study Area

### 1.2 Survey Details

The following two types of surveys need to be conducted to fulfill the scope of work

1. Video data extraction survey to measure the classified (by vehicle type) volume of turning traffic at the specified intersections and classified volumes on the mid-block sections. Recorded videos will be provided to vendor by IIT Madras.
2. GPS based vehicle tracking survey of sample vehicles to gather the data on position (Latitude and Longitude), speed and time along the two alternative corridors 1 and 2 in both directions.

The details of all the above surveys are explained in the following sections.

### 1.3 Survey Days & Timings

Both the surveys should be carried out as per the prescribed days and timings given below (Table 2).

**Both surveys need to be conducted concurrently.**

**TABLE2 Date and Timings for Surveys**

Days of Survey*	Timing of Survey on Each Day	
	GPS	Volume Data Extraction from Video (recorded videos will be provided)
	<b><u>3 Sessions per day</u></b>	<b><u>3 Sessions per day</u></b>
1.Sunday		
2. Monday or Friday	07.30 am to 10.30 am	09.00 am to 10.00 am
3. Tuesday or Wednesday or Thursday	12.00 noon to 2.00 pm 05.00 pm to 8.00 pm	01:00pm to 02:00pm 05.00 pm to 06.00 pm

\* In the event of any unforeseen circumstances beyond the control of vendor such as bad weather, special events, and traffic diversions disrupting a session(s) significantly (more than one hour), the survey for the disrupted session(s) should be carried out at the same timing(s) on the unaffected alternate day (Sunday for Sunday, Friday for Monday, Wednesday or Thursday for Tuesday) mentioned in the Table2. The vendor may quote contingent costs per extra session (in lieu of disrupted session) as a separate line item.

Detailed work plan for conducting the above surveys (schedules, equipment, manpower and resource allocation and planning) as per the prescribed format (Annexure I) should be part of the quotation.

## **2.0 TASKS**

**FOLLOWING ARE THE SPECIFIC TASKS INVOLVED IN THE AFTER DATA COLLECTION AND ANALYSIS.**

### **2.1 Mobilisation**

This task includes mobilization of both human and material resources (such as vehicles, GPS instrument) for the survey. Staff deployment planning shall be done paying due attention to the project plan and deliverable timelines.

A kick-off meeting will be held at IIT Madras, prior to the planned commencement of surveys to serve the following purposes:

- Introduction between consultant and client team
- Establish general communication
- Review and assessment of consultant’s approach and work plan. The approval of detailed work plan must be obtained in writing from IIT Madras before commencement of surveys.



## **2.2 Extraction of Video Data**

1. Classified volume count extracted from video data aggregated for every 1 minute interval should be submitted in separate spreadsheet files for each midblock and intersection. The data shall be indexed by date, time, direction of flow, intersection/mid-block location names and numbers, and road names. The format is provided in Annexure II.
2. For each intersection, extraction of data should be done for straight/through, left turning and right turning traffic separately. If there are significant numbers of vehicles making U-turns, this must be recorded separately.
3. The following seven categories shall be counted separately from the video: Two Wheelers (all categories), Auto-rickshaws, Car/Van/Jeep, Light Commercial Vehicles (Goods Van, Tempo Travelers), Heavy Motor Vehicles (Buses, Trucks, Multi Axle Vehicles and Tractors).

### **Deliverables – Extracted Video Data for Volume Counts**

The consultant has to submit the spreadsheet files of extracted data in CDs/DVDs. The format for submission is given in Appendix 2.

## **2.3 GPS Based Vehicle Tracking Survey**

1. The consultant should use high accuracy (10m or less) GPS units for collecting the GPS data recorded at one second intervals. The make and model of GPS units have to be approved by IIT Madras.
2. Three types of vehicles shall be used for the GPS survey – Two Wheeler, Car, and Auto-rickshaw. The consultant has to arrange vehicles for mounting GPS units.
3. The vehicles shall collect data on four routes. The details of the routes are given in Table 3 below.
4. One set of vehicles refers to one two wheeler, one car, and one auto-rickshaw.
5. On each of the four routes, the first set of vehicles should start from the origin at the session start time for each session. Subsequent sets of vehicles should depart from their origin every 10<sup>th</sup> minute thereafter.
6. The last set of vehicles on each of the routes should be departing from their origins at session end times.

**TABLE 3 Details of Routes for GPS Survey**

Sl.No	Route	Origin	En-route Intersections (Refer Figure 2)	Destination
1	Route A	1	2-3-4-5-6	7
2	Route B	1	2-12-11-10-9-8	7
3	Route C	7	6-5-4-3-2-12-13	1
4	Route D	7	8-9-10-11-12-13	1

**Deliverables - GPS Data**

1. The consultant should submit the data (Latitude, longitude, time stamp and speed) from the GPS units in tabular form.
2. The output submitted should be in spreadsheet format (in CDs / DVDs) with the following additional information: route name, vehicle type and last four digits of registration number, start and end times.

Analysis of GPS data: The following information has to be generated and presented using the GPS data

- a. Least Average Travel Times for selected OD pairs (see Annexure IV for selected OD pairs)
- b. Average Route Travel Times for Alternate Routes for selected O-D pairs
- c. Speed Profiles (number of links under the five speed range categories). A link is defined as road section between two consecutive intersections. The five speed range categories are: < 10 kmph, 10 – 20 kmph, 20 – 30 kmph, 30 – 40 kmph, and > 30 kmph.
- d. Delay times (when speeds < 5 km/h) for Alternate Routes for Selected O-D Pairs
- e. A comparative analysis of the above statistics in relation to “Before Study” data provided by IIT Madras.

All the above deliverables must be aggregated at 20 minute and 1 hour intervals.

**2.4 User Perception Survey**

User perception survey is required to evaluate the perception of users to the two different mediums of information dissemination (web site and VMS).

**2.4.1 Web-based Survey**

Web-based survey questionnaire survey has to be done from following two samples

- o from regular visitors to the site
- o from new users



Web-based survey has to be based on the format given in Annexure III and should be approved by project team at IIT Madras. 400 valid responses (200 from regular visitors of the website and 200 from first-time visitors to the website) are required for web-based survey.

#### **2.4.2 VMS Feedback Questionnaire**

- For VMS feedback, both intercept surveys (respondents are travelers intercepted when travelling along the study corridor) and surveys at residences / office areas need to be done.
- 200 is the required sample size for both intercept survey and surveys at residences/office areas (therefore 400 total valid responses are required).

Questionnaire must be based on the format given in Annexure III and should be approved by project team at IIT Madras.

#### **2.4.3 Deliverables – User Perception Survey Data**

- For the web-based survey the data (in database and spreadsheet format) containing all the responses including data on whether the survey was completed by regular or new user, the name and contact phone number of respondent, the IP address of the machine on which the survey was completed, and the date and time of starting and completing the survey.
- For the VMS survey, the hard copy of the survey forms, a database of the responses compiled including the data on the name and contact phone number of respondent, whether survey was intercept survey or carried out at a residence/office, date and time of starting and completing the survey, location of conduct of the survey (nearest intersection roads/landmark) must be provided.

#### **ANALYSIS DELIVERABLES**

- A report summarizing the overall findings from the survey with clear conclusions on effectiveness, usefulness, level of satisfaction of information provided segmented by socio-economic and travel characteristics of the respondents.

### **2.5 Study Period**

The total time for completing this study (including submission of deliverables) is 15 days from the date of commencement of survey work. Work order is expected to be issued during the period Mar – Apr 2014. The actual start of survey work will be decided based on mutual considerations.

### **3.0 WORK PLAN & COST**

The consultant has to submit a detailed work plan (as per Annexure I) and a task wise split up of cost with the quotation. The cost should separately show unit cost for intersection counts, mid-block counts, GPS surveys by each vehicle type, and each survey (web-based and VMS).

#### **3.1 Data Consistency**

The survey data should be consistent and complete as per the specified format.

### **3.2 Quality of Work**

The survey consultant has to ensure the quality of collected data and ensure that all requirements in this specification are strictly adhered to. Quality check will be done by client to check the accuracy of the collected data. The final payment of 15% is contingent upon this.

### **3.3 Document Usage**

The study and all associated data (data sheets, video and audio recordings, GPS records, electronic files, etc.) will be the property of the client (Indian Institute of Technology Madras) and shall in no manner be shared/reproduced / utilized for any purpose without the written approval of the client.

### **3.4 Quotation Submission and Deadline**

The consultant has to submit the bid for the above scope of work **in two parts – technical and financial, in separate sealed envelopes**. The quotation must be valid for a period of six months. Two hard copies of the quotation should be submitted so as to reach the address mentioned below before **5:00 pm on 25<sup>th</sup> March 2014**.

## **4.0 Other Terms and Conditions**

4.1 IIT Madras reserves the right to modify the number of intersections, mid-blocks, GPS study frequency for each vehicle type, number of valid survey responses for VMS and web-based user perception survey or not award the contract.

4.2 All bidders should have conducted similar traffic count data and GPS study as well as user surveys. List of studies undertaken and references for contact must be provided as part of technical bid. Every bidder must have carried out at least one similar study order with worth of at least Rs. 10 Lakhs or several similar smaller studies totaling to a minimum of Rs. 25 lakhs.

4.3 All bidders must involve, in this project, manager / technical person with a minimum qualification of M. Tech in Transportation Engineering or a transportation expert with minimum of three years of experience in traffic and transportation area. This person must be an existing employee in the roll of the company for a period of at least 6 months before March 25<sup>th</sup>, 2014. The CV of this person must be attached with the technical bid.

4.4 Liability/Accident: The contractor shall keep indemnified IIT Madras against all delays, losses and claims for injuries/death and damages to any person or property whatsoever which may arise out of or in

consequence of the After Study work and against all claims, demands, proceedings, damages, costs, changes, expenses whatsoever in respect thereof in relation thereto. The contractor should comply with all Govt. (State & Central) statutory requirements as per law.

4.5 Permissions: All required permissions for the After Study from Police and Government authorities will be obtained by IIT Madras.

#### 4.6 DISPUTES/ ARBITRATION

In the event of a dispute or a difference of any nature whatsoever between the parties during the course of performance of respective obligations arising out of this Agreement, the parties agree to refer the matter to the Heads of the Institutions to resolve the disputes keeping in view the best interest of the Parties and in keeping with the spirit of performance of this Agreement. If the matter still remains unresolved, then the same may be referred to International Centre for Alternative Dispute Resolution, (ICADR) for arbitration, instead of going to the Courts directly. The contract awarded will be interpreted under Indian Laws.

#### 4.7 JURISDICTION

The Parties to this Agreement hereby declare that the Courts in Chennai alone are competent to deal with disputes, if any, arising out of this Agreement.

### **ADDRESS FOR SUBMITTING QUOTATIONS**

The Project Coordinator  
ATIS Project  
Transportation Engineering Division  
Department of Civil Engineering  
Indian Institute of Technology Madras  
Chennai – 600036

**For clarification on Scope of Work, please contact: Gitakrishnan Ramadurai, Ph: 95000 90172 or e-mail: gitakrishnan@iitm.ac.in.**

## **Annexure I**

### **Detailed Work Plan for “After Study”**

#### **1. Video Data Extraction**

- a. Format for data extraction provided in Annexure II

#### **2. GPS Vehicle Tracking Survey**

- a. Number of round trips per vehicle per day
- b. Total number of vehicles by type per day
- c. Departure times of each vehicle at each origin
- d. Specifications (including make and model) of GPS units proposed to be employed
- e. GPS communication, if any, proposed to be adopted
- f. Plan for mobilization of vehicles (Own/Hired/Other)

#### **3. User Perception Survey**

- a. Format of final questionnaire to be submitted before implementing

## Annexure II

### Format for Volume Data Extraction

The volume data to be extracted from the video has to be included in the spreadsheet. Separate files have to be created for each midblock section and intersection. In the first worksheet of the file, mention the location, time, date, and picture of the location. From the second worksheet, give the classwise volume counts for each route. For e. g., at the midblock section of AnnaUniversity, the direction of traffic flow from Cancer Institute to RajBhavan is 1-2, and from Raj Bhavan to Cancer Institute is 2-1. For the routes 1-2 and 2-1, separate worksheets have to be created and the classwise volume data for each minute has to be entered in the following format:

<b>S.no</b>	<b>Minutes</b>	<b>Two wheeler</b>	<b>Auto</b>	<b>Car/Jeep/Van</b>	<b>LCV</b>	<b>HMV</b>	<b>Total</b>
1	9:01	74	12	35	5	2	128
2	9:02	89	5	39	0	0	133
3	9:03	38	6	9	1	0	54
4	9:04	81	6	23	2	0	112
5	9:05	63	12	12	1	0	88
6	9:06	87	6	32	2	1	128
7	9:07	52	5	13	5	1	76
8	9:08	52	5	28	1	0	86
9	9:09	69	2	19	1	0	91

### Annexure III

#### a. Web-based Survey Questionnaire

Home: Area \_\_\_\_\_

Work place: Area \_\_\_\_\_

1. Gender
  2. Age
  3. Education level
    - a) High School or less b) Graduate c) Post Graduate
  4. No. of vehicles owned by household : \_\_\_\_\_
  5. Leave Home for Work at \_\_\_\_\_ AM/PM
  6. Reach work at \_\_\_\_\_ AM/PM
  7. Work start time \_\_\_\_\_ AM/PM
  8. Number of years you are in Chennai: < 2 / 3-5 / 6 or more
  9. Driving experience: \_\_\_\_\_ years
  10. Distance from home to work: < 5 km/6-10 km/ 11-15 km/ 16-20 km/ > 20km
  11. Number of different routes you take to work: 1 / 2 / 3/ 4+
  12. Means of travel to work (tick all that apply)  
Walk/TW/Car/Bus/Train/Auto-rickshaw/Other
- If Car/TW,
- 12a) How many co passengers while travelling to or from work?
  - 12b) Whether you regularly combine multiple stops/activities while travelling to or from work (Eg. Shopping, Pick-up/Drop-off)? Yes / No
13. Monthly household income: <10000/ 10001–20000 / 20001-30000 / 30001-40000 / 40001-60000 / >60000
  14. Field of work: IT/ Govt./ Banking or services/ Self employed/ Manufacturing/ Construction/ Academic / Other
  15. Point of entry into study corridor: \_\_\_\_\_
  16. Point of exit from study corridor: \_\_\_\_\_
  17. Route taken normally on this study corridor (tick the roads):

<input type="checkbox"/> Taluk Office Road	<input type="checkbox"/> Sardar Patel Road
<input type="checkbox"/> Taramani Link Road	<input type="checkbox"/> Velachery Main Road
<input type="checkbox"/> Velachery Bypass Road	<input type="checkbox"/> OMR / IT Corridor



18. How often do you use internet?

	Many times a week	Few times a week	Never/Rarely
At home			
At work			
Through mobile			
For route guidance information			
For public transit information			

19. The web-based traveller information will be helpful in reducing

- Travel time : Yes / No / Don't know / Can't Say  
 Travel stress : Yes / No / Don't know / Can't Say  
 Uncertainty due to traffic congestion : Yes / No / Don't know / Can't Say

20. The traveller information provided on the web-page is:

- Accurate : Yes / No / Don't know / Can't Say  
 User friendly : Yes / No / Don't know / Can't Say  
 Helpful in selecting routes : Yes / No / Don't know / Can't Say  
 Helpful in planning time of journey : Yes / No / Don't know / Can't Say

21. I plan to use the information from this webpage while making trips:

Daily / few times a week / few times a month / few times a year / Never

22. Rate your overall level of satisfaction with the traffic and traveller information on this webpage:

Very satisfied / satisfied / Neither satisfied nor dissatisfied / dissatisfied / very dissatisfied.

23. Which of the following information will be useful for making a trip? (tick all that apply)

- Alternate Routes and Travel times     Congestion map  
 Traffic Delays     Traffic News and Alerts  
 Live Traffic Camera     Others

24. Based on the information, did you?

- Change when you leave for the trip     Change route  
 Change mode of travel     Did not change travel plan

25. If you changed route based on information, which of the following roads did you take (tick the roads):

- |  |  |
|--|--|
| <input type="checkbox"/> Taluk Office Road     | <input type="checkbox"/> Sardar Patel Road   |
| <input type="checkbox"/> Taramani Link Road    | <input type="checkbox"/> Velachery Main Road |
| <input type="checkbox"/> Velachery Bypass Road | <input type="checkbox"/> OMR / IT corridor   |

26. How often do you travel on the following roads?

	Daily	Few times a week	Few times a month	Few times a year	Never travelled on the road
SP Road					
IT Corridor					
Tharamani Road					
Velachery Main Road					

**b. VMS Feedback Questionnaire**

Home: Area \_\_\_\_\_

Work place: Area \_\_\_\_\_

1. Gender
  2. Age
  3. Education level
    - a. High School or less
    - b. Graduate
    - c. Post Graduate
  4. No. of vehicles owned by household : \_\_\_\_\_
  5. Leave Home for Work at \_\_\_\_\_ AM/PM
  6. Reach work at \_\_\_\_\_ AM/PM
  7. Work start time \_\_\_\_\_ AM/PM
  8. Number of years you are in Chennai: < 2 / 3-5 / 6 or more
  9. Driving experience: \_\_\_\_\_ years
  10. Distance from home to work: < 5 km/6-10 km/ 11-15 km/ 16-20 km/ > 20km
  11. Number of different routes you take to work: 1 / 2 / 3/ 4+
  12. Means of travel to work (tick all that apply)  
Walk/TW/Car/Bus/Train/Auto-rickshaw/Other
- If Car/TW,
- 12a) Howmany co passengers while travelling to or from work?
  - 12b) Whether you regularly combine multiple stops/activities while travelling to or from work (Eg. Shopping, Pick-up/Drop-off)? Yes / No
13. Monthly household income: <10000/ 10001–20000 / 20001-30000 / 30001-40000 / 40001-60000 / >60000
  14. Field of work: IT/ Govt./ Banking or services/ Self employed/ Manufacturing/ Construction/ Academic / Other
  15. Point of entry into study corridor: \_\_\_\_\_
  16. Point of exit from study corridor: \_\_\_\_\_
  17. Route taken normally on this study corridor (tick the roads):

<input type="checkbox"/> Taluk Office Road	<input type="checkbox"/> Sardar Patel Road
<input type="checkbox"/> Taramani Link Road	<input type="checkbox"/> Velachery Main Road
<input type="checkbox"/> Velachery Bypass Road	<input type="checkbox"/> OMR

- 18a. The VMS board was prominent and easy to see from a distance. Yes/No/ don't know
- 18b. The text on the VMS board was legible and readable. Yes/No / don't know
- 18c. The message on the VMS board was easy to understand. Yes / No / don't know
- 18d. There was sufficient time to read the message. Yes / No / don't know
- 18e. I could read the message from a sufficient distance before the junction. Yes / No / don't know
- 18f. There was sufficient time to modify my route if needed. Yes / No / don't know.
- 18g. I am willing to change route based on VMS information. Yes / No / don't know
- 18h. I actually changed my route based on VMS information. Yes / No / don't know
- 18i. If yes to 18h , which roads did you take?

- |  |  |
|--|--|
| <input type="checkbox"/> Taluk Office Road     | <input type="checkbox"/> Sardar Patel Road   |
| <input type="checkbox"/> Taramani Link Road    | <input type="checkbox"/> Velachery Main Road |
| <input type="checkbox"/> Velachery Bypass Road | <input type="checkbox"/> OMR / IT Corridor   |

20. The VMS information will be helpful in reducing

- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| Travel time                           | : Yes / No / Don't know / Can't Say |
| Travel stress                         | : Yes / No / Don't know / Can't Say |
| Uncertainty due to traffic congestion | : Yes / No / Don't know / Can't Say |

21. The traveller information provided on the VMS is:

- |                             |                                     |
|-----------------------------|-------------------------------------|
| Accurate                    | : Yes / No / Don't know / Can't Say |
| User friendly               | : Yes / No / Don't know / Can't Say |
| Helpful in selecting routes | : Yes / No / Don't know / Can't Say |

22. I plan to use the VMS information while making trips:

Daily / few times a week / few times a month / few times a year

23. Rate your overall level of satisfaction with the traffic and traveller information provided via the VMS:  
Very satisfied / satisfied / Neither satisfied nor dissatisfied/ dissatisfied / very dissatisfied.

24. How often do you travel on the following roads?

	Daily	Few times a week	Few times a month	Few times a year	Never travelled on the road
SP Road					
IT Corridor					
Tharamani Road					
Velachery Main Road					

#### **Annexure IV**

##### **List of selected OD pairs:**

1. Raj Bhavan - SRP Tools
2. Raj Bhavan - Taramani Pillayar Koil
3. SRP Tools - Little Mount
4. SRP Tools - Check Post
5. Tidel Park - Check Post
6. Vijayanagar - Madhya Kailash
7. Vijayanagar - Kotturpuram
8. Madhya Kailash - Vijayanagar