4. METHODOLOGY

4.1 ARRANGEMENTS AT DATA COLLECTION SITES

The data collection sites were located at a distance of 25m away from the intersection to ensure traffic noise mapping of the near-by deceleration lane while remaining uninfluenced of noise from other lanes of the intersection. The sites had firm and level ground and it was endeavored during the reconnaissance survey to select such sites where there was no obstruction between the source and the receiver as far as practicable. In most of the cases, the sites were flanked with building façade while some other sites had boundary wall of heights varying from 2 to 3m.

The general arrangement of data collection site showing the source of traffic noise, median, façade line and point of observation on the deceleration lane is shown in Figure 4.1. The source of traffic noise was assumed to be lying on the center of the carriageway at a height of 0.5m in accordance with the literature. Typically, the same height is attained by the kerb and plinth margin for the ground floor level. The sound signals were assumed to spread in spherical propagation pattern from the source during the duration of a traffic jam. The engine operating condition may be in running or idling condition with instances of honking. Eventually, these signals would impinge upon the receiver located 1m in front of the building façade line to additionally intercept reflected signals. Simultaneous reading of the sound level meter was obtained for a maximum of three stories of a building on the Ground Floor (GF) level, First Floor (FF) level and Second Floor (SF) level, owing to limited availability of instrument. The margin width between façade and carriageway was on account of the width of footpath, drain and building setback etc.

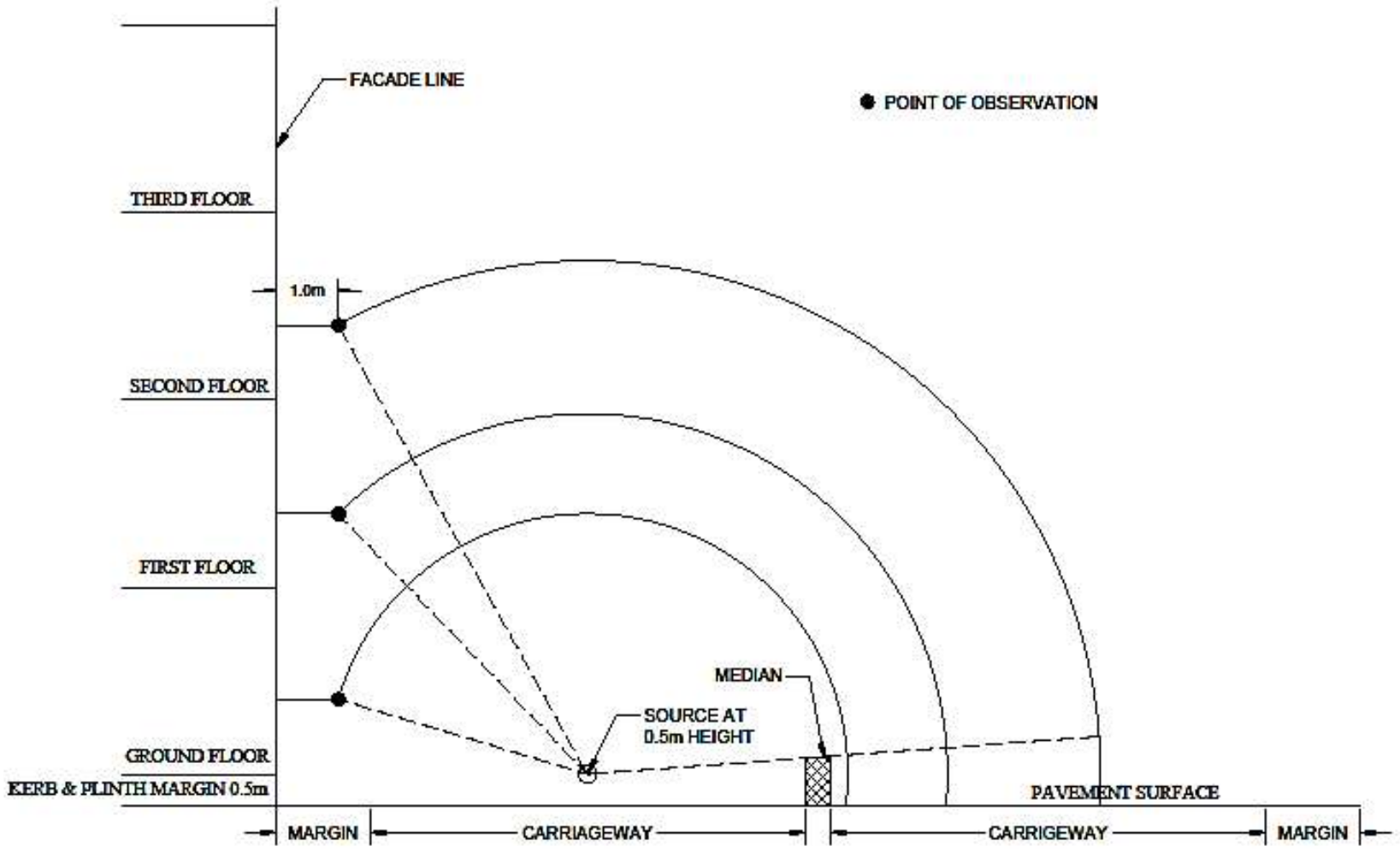

Figure 4.1. General arrangement showing source of traffic noise, median, façade line and point of observation on the deceleration lane

4.2 SOUND LEVEL METER

Out of three sound level meter used for the study, a Bruel & Kjaer integrating-averaging Class 1 instrument 2240 as shown in Figure 4.2 was used after due calibration using Type 4231 calibrator. This instrument was placed on the GF level and 90mm windscreen was used at the time of outdoor data collection. Apart from this, two digital sound level meters of METREX make type 2 instrument as shown in Figure 4.3 after calibration with Bruel & Kjaer multifunction acoustic calibrator were mounted on FF and SF levels. Both types of sound level meter were powered by a replaceable battery whose adequate stock was ensured at the site.

Figure 4.2. Bruel & Kjaer integrating-averaging sound level meter 2240

Figure 4.3. Metrex digital sound level meter

4.3 METHODOLOGY FOR DATA COLLECTION

The sequencing of major activities involved in present study is shown as a flowchart in Figure 4.4, after which the methodology for data collection is discussed in the subsequent sub-sections.

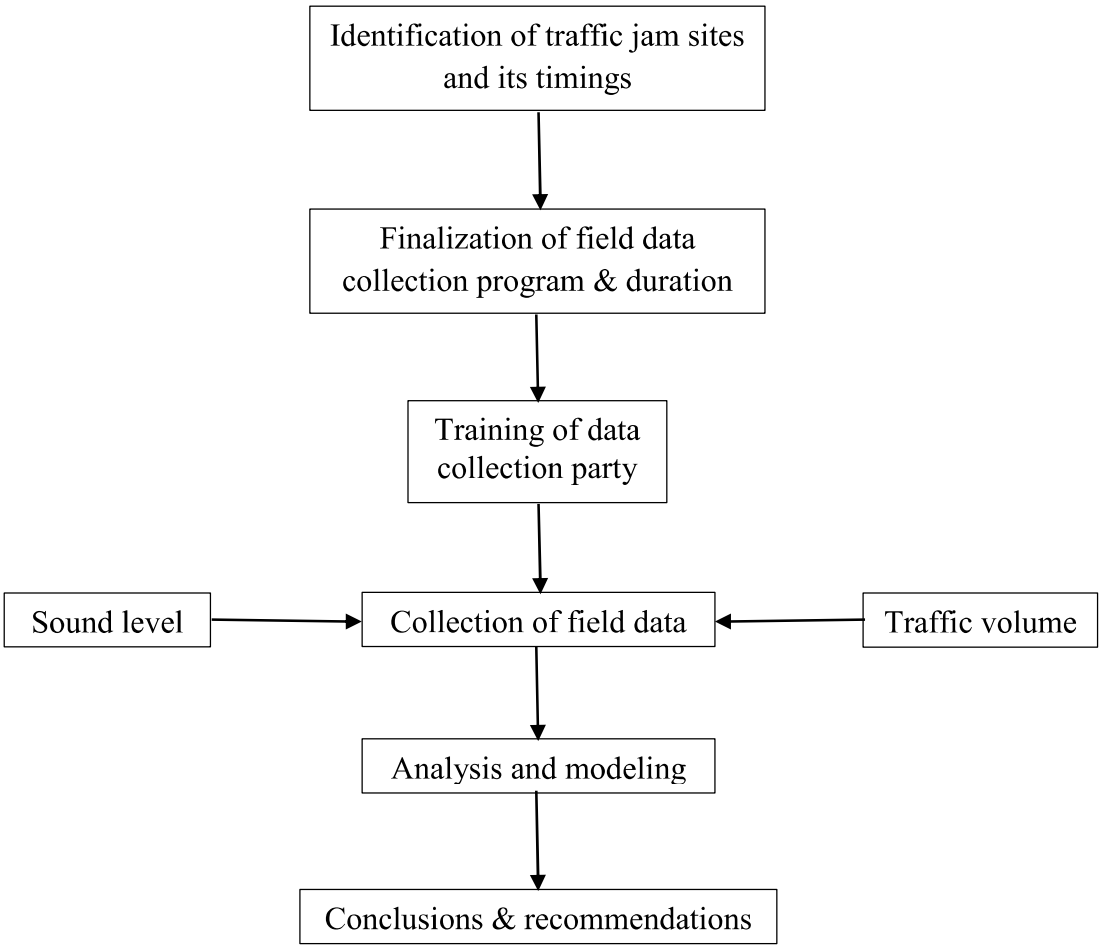

Figure 4.4. Flowchart of major activities of the research

4.3.1 IDENTIFICATION OF TRAFFIC JAM SITES AND ITS TIMINGS

Traffic jam sites and timing's typically for the morning and evening during peak traffic duration were identified through reconnaissance and documented in Table 3.2. Reconfirmation of these timings from the nearby respondents was done well before the actual data collection.

4.3.2 FINALIZATION OF FIELD DATA COLLECTION PROGRAMME & DURATION

Adequate field data was essential for discerning and describing the associated environmental elements of road traffic jam being pursued in the present study. In order to do this effectively and smoothly, the identified intersections were serialized beginning from the nearest location from the Banaras Hindu University. A sustained programme of data collection for 4 years beginning from February 2013 to April 2017 was chalked out. For every leg of the intersection, 8 datasets were necessary so as to utilize 6 data sets for model development and 2 data sets for validation of the model. In the effort to cover 65 legs of 19 intersections, it was possible to collect 2 dataset per year, barring extreme winter and monsoon period. Data collection was conducted during fair weather. No data was collected when wind speed exceeded 5 m/s.

4.3.3 TRAINING OF DATA COLLECTION PARTY

The data collection party consisted of the following team members who were trained to work in a well-coordinated manner for obtaining the field data.

- 3-persons for simultaneous recording of data from the sound level meter for 10 minutes at various building floor levels.
- 1-person for video recording of vehicular traffic involved in a traffic jam for 10 minutes in the trap length of 50m which was marked suitably on the ground.
- 1-person for coordinating the concurrent activities and ensuring safety at the site while the data collection was in progress.

4.3.4 SOUND LEVEL

For the recording of noise level at any leg of an intersection, the sound level meter was positioned on the GF, FF and SF levels at a height of 1.20 m from the floor level and 1.0m away from the façade line such that its microphone was facing traffic jam perpendicularly. All measurements were made with weighting network 'A' and time response characteristics 'Fast'. For FF and SF levels, the balcony of the building was used whose availability was confirmed during reconnaissance. Depending on the situation, the instruments were either hand held, tripod mounted or mounted on the boom of a PA system stand. The verticality of instruments at various floor levels was ensured before the commencement of data collection. Some on-site photographs are shown in Photographs 4.1 to 4.3.

Photograph 4.1. Data collection at GF level (Bhelupur, towards Durgakund)

Photograph 4.2. Data collection at FF level (Durgakund, towards Ravidas Gate)

(a) (b)

Photograph 4.3. Data collection at FF level (a) Bhelupur, towards Rathyatra
(b) Sankatmochan, towards Durgakund

In consonance with the literature that 10 minutes of sound level data at 10 to 15 seconds interval would adequately represents the acoustic energy for that hourly duration, sound level data was collected for 10 minutes' duration at intervals of 10 seconds, thereby providing 60 readings per data set. For the purpose of documentation, the total period of traffic jam and its timings was also obtained. There were instances when the data collection party would witness premature release of traffic jam due to administrative or police intervention. Such data were discarded and obtained afresh.

4.3.5 TRAFFIC VOLUME

Simultaneous with the sound level data, traffic volume data was also obtained through video recording technique for the 10-minute duration within the trap length of 50m. The video recorder was suitable placed to cover the event, whose location was decided during the reconnaissance. Later, classified traffic volume count was obtained by replaying the video.

4.3.6 TRAFFIC SPEED

Traffic jam is associated with stoppage of the vehicular stream and its progressive build-up due to non-availability of headway for vehicular movement in the forward direction. It is associated with adjustment and readjustment of vehicle position, leading to gradual densification and occupancy over the pavement area, thereby presenting a complex scenario of inter-vehicular interaction and manoeuvers. Since the traffic was in a standstill position during a traffic jam, the traffic speed was considered insignificant.

4.3.7 FORMAT FOR DATA COLLECTION

Suitable formats for obtaining details of data collection site, classified traffic volume count and traffic noise level were prepared as shown in Plate 1 to 3.

DETAILS OF DATA COLLECTION SITE

Date: Intersection:
Day: Leg:
Time: Locality:

1. Median: Provided/Not provided; Width:……, Height:……; Type- CC/Stone/Brick/Others
2. Pavement: Type-BT/CC; Divided/Undivided; Width: ……m; Available width for traffic ……m.
3. Number of lanes:
4. Drain: Shape-Rect/Trapez/V-shaped; Lined/Unlined; CC/Stone/Brick/Others; Top width: …....m.
5. Footpath: Earthen/Stone/CC/BT/Brick/Others; Width:…….., Height from road level:……
6. Façade line from edge of footpath: …….m.
7. Vegetation cover: Dense/Sparse/Barren foliage; Girth: …….m.
8. Telephone/Electricity poles: Yes/No
9. Peak flow timings: Morning ……AM; Evening …….PM.
10. Building details: No. of story's ……; Ht. of each story above footpath level-GF …m, FF ….m, SF …..m

Landuse pattern: Residential/commercial/industrial/silence zone

Plate 1. Format for details of data collection site

CLASSIFIED TRAFFIC VOLUME COUNT

Date: Intersection:
Day: Leg:
Time: Locality:
Peak type: Morning/Afternoon/Evening Direction: From …… To ……...

Vehicle Type	10 minute vehicular Count	Total
2- Wheeler		
3- Wheeler		
Car		
Jeep		
LCV		
Tractor		
Bus		
Truck		
Rickshaw		
Cycle		
Others		

Plate 2. Format for classified traffic volume count

TRAFFIC NOISE LEVEL

Date: Intersection:
Day: Leg:
Time: Locality:
Peak type: Morning/Afternoon/Evening SLM distance from pavement edge:
Number of story: Floor: GF/FF/SF
Height of SLM from floor: 1.2m Timing of traffic jam: …….. to …….

Time		Noise Level dB(A)	Time		Noise Level dB(A)
Minute(s)	Seconds		Minute(s)	Seconds	
1	10 20 30 40 50 60		6	10 20 30 40 50 60	
2	10 20 30 40 50 60		7	10 20 30 40 50 60	
3	10 20 30 40 50 60		8	10 20 30 40 50 60	
4	10 20 30 40 50 60		9	10 20 30 40 50 60	
5	10 20 30 40 50 60		10	10 20 30 40 50 60	

Plate 3. Format for traffic noise level

4.3.7 FORMAT FOR DATA LISTING

A suitable format for listing of data obtained from field was developed as shown in Plates 4(a) and 4(b).

Name of intersection: Leg: Floor:

Data set number	1	2	3	4	5	6	7	8
Distance of façade line from centre of carriageway, m								
Horizontal distance of observer vertical from centre of carriageway, m								
No. of story								
Height of story, m								
Height of median, m								
Height of SLM above GF/FF/SF level, m	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Distance between source and point of observation at GF/FF/SF, m								
Date								
Day								
Timing of traffic jam								
Duration of traffic jam, minutes								
Time of noise level data								
Duration of noise level data, minutes	10	10	10	10	10	10	10	10
Time elapsed for noise level data, seconds								
10								
20								
30								
40								
50								
60								
70								
80								
90								
100								
110								
120								
130								
140								
150								
160								
170								
180								
190								
200								
210								
220								
230								
240								
250								
260								
270								
280								
290								
300								

Plate 4(a). Format for listing of field data

310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600								
Time for which traffic data was obtained, minutes	10	10	10	10	10	10	10	10
Classified traffic count 2-w 3-w car Jeep LCV Tractor Bus Truck Rickshaw Cycle Others (hand drawn)								
Total units								

Plate 4(b). Format for listing of field data