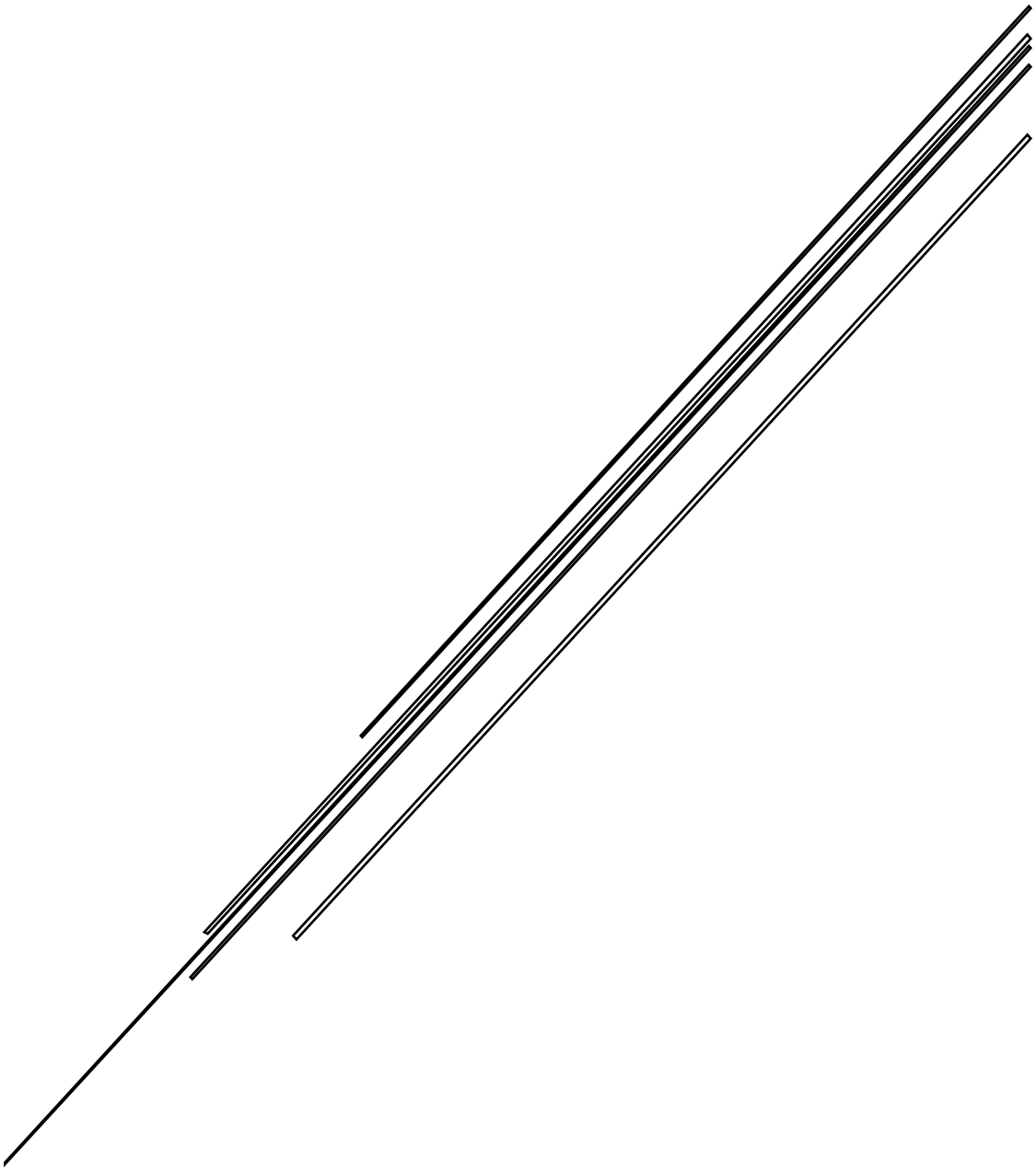
TRAFFIC ENGINEERING LAB RECORD

AUTUMN, 2017



Department of Civil Engineering, IIT Bombay

CE 740: Traffic Engineering

CE 740: TRAFFIC ENGINEERING LAB

July – December, 2017

Name: _____ Roll No: _____

Group No: _____ Other Group Members:

No	Tests	Page	Date	Marks	Signature of TA
1A	Study of Driver Testing Unit	1			
1B	Study of Driver Vision Screen Tester	5			
2	Spot Speed Study	11			
3	Measurement of Travel Time and Delay for Congested Corridor	33			
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9	Saturation Flow Measurement	105			
10	Intersection Delay Measurement	125			
11	Gap Acceptance Study of Uncontrolled Intersection	137			
12	Pedestrian Behaviour Study	153			
	End Semester Evaluation	-			

Marks for the lab by TAs (out of 120) : . . . . . .

Marks for the lab viva/exam by Instructor (out of 80) : . . . .

Total marks (out of 200) : . . . .

Signature of the Student **Signature of the Instructor**

1A. DRIVER VISION TESTING

Aim:

Equipment:

Theory:

Procedure:

Observations:

CIVIL ENGINEERING DEPARTMENT, IIT.BOMBAY

TRANSPORTATION SYSTEMS ENGINEERING LAB.

DRIVER TESTING UNIT I

TEST FORM

Dated the .....

Name & Address : .....

.....

Age ..... Sex .....

---

1. Reaction Time (in 1/100 second)

	Simple 0.38 Sec. Alertness Single Definit response	Comple 0.67 Sec. Situation Involving choice or discre-minatio G-A-G-A.... R
1st Trial :	.....	.....
2nd Trial :	.....	.....
3rd Trial :	.....	.....
Average :	.....	.....

2. Visual acuity : Sharpness of Vision (Level of fineness)

Right Eye 6/12 must	Left Eye 6/12 must	Both Eyes 6/12 must
6/.....	6/.....	6/.....

3. Field of vision : ability to see in lateral direction without moving the neck.(in degrees) Reqd. 75°

Right Eye : 1st Trial .....2nd Trial..... Average.....

Left Eye : 1st Trial .....2nd Trial.....Average .....

4. Distance judgement: To peracine relative position of object (error in cms)

1st Trial .....2nd Trial.....3rd Trial....
combined a error 7.5 cm.
Total .....

Result:

1. Field of Vision :
    a. Right Eye :
    b. Left Eye :
2. Distance Judgement Error :

Inference:

Date: **Signature of TA**

1B. DRIVER VISION TESTING

Aim:

Equipment:

Theory:

Procedure:

Observations:

Keystone DVS-GT Deluxe Record Form

For use with Model 1158
DVS-GT Deluxe Screeners

Name _____ Date _____

Occupation _____ Age _____

Does the examinee wear: Glasses ☐ or Contacts ☐ (If yes, how often?) Always ☐ Sometimes ☐

What kind of Vision Correction? Distance Only ☐ Reading ☐ Multifocals ☐

TEST DESCRIPTION	UNACCEPTABLE	MARGINAL	ACCEPTABLE
RIGHT EYE: ACUITY A B C 1. 6 = 547638 7.5 = 428576 9 = 943852 2. 12 = 795823 15 = 357248 18 = 7236 3. 21 = 9574 30 = 92 60 = 5	6/21 = 9574 6/60 = 5 6/18 = 7236 6/30 = 92 6/15 = 357248	(One Miss Allowed Per Line) 6/12 = 795823	6/9 = 943852 6/7.5 = 428576 6/6 = 547638
LEFT EYE: ACUITY A B C 1. 6 = 745932 7.5 = 578236 9 = 346752 2. 12 = 534268 15 = 752386 18 = 6254 3. 21 = 8453 30 = 85 60 = 3	6/21 = 8453 6/60 = 3 6/18 = 6254 6/30 = 85 6/15 = 752386	(One Miss Allowed Per Line) 6/12 = 534268	6/9 = 346752 6/7.5 = 578236 6/6 = 745932
NIGHT VISION TEST Swich to "Nite" on the control panel			
BOTH EYES: NIGHT ACUITY A B C 1. 6 = 857432 7.5 = 674235 9 = 382457 2. 12 = 563472 15 = 859423 18 = 8927 3. 21 = 2978 30 = 43 60 = 9	6/21 = 2978 6/60 = 9 6/18 = 8927 6/30 = 43 6/15 = 859423	(One Miss Allowed Per Line) 6/12 = 563472	6/9 = 382457 6/7.5 = 674235 6/6 = 857432
ACUITY BINOCULAR VISION TEST Swich to "Day" on the control panel			
BOTH EYES A B C 1. 6 = 857432 7.5 = 674235 9 = 382457 2. 12 = 563472 15 = 859423 18 = 8927 3. 21 = 2978 30 = 43 60 = 9	6/21 = 2978 6/60 = 9 6/18 = 8927 6/30 = 43 6/15 = 859423	(One Miss Allowed Per Line) 6/12 = 563472	6/9 = 382457 6/7.5 = 674235 6/6 = 857432
Have examinee remove corrective lenses - Insert 3-meter lens plunger			
LEFT EYE: INTERMEDIATE ACUITY (Occlude right eye) **Block "A" letters**	Not able to read any letter on the screen		(One or more correct per line) 6/21 = KHNR 6/30 = SZ 6/60 = C
RIGHT EYE: INTERMEDIATE ACUITY (Occlude left eye) **Block "C" letters**	Not able to read any letter on the screen		(One or more correct per line) 6/21 = HSRZ 6/30 = KN 6/60 = V
Have examinee put on corrective lenses - Release 3-meter Lens plunger			
COLOUR (both eyes) **Block "B" letters** Y R G G Y R R G Y Y Y R R R G	Two or More Incorrect Y R G G Y R R G Y Y Y R R R G	Missing One Y R G G Y R R G Y Y Y R R R G	All Correct Y R G G Y R R G Y Y Y R R R G
OPTIONAL TEST (Reverse one slide position for Binocular 3-meter Acuity Test - Lens plunger should be inserted)			
INTERMEDIATE ACUITY (both eyes) A B C 1. 6 = 857432 7.5 = 674235 9 = 382457 2. 12 = 563472 15 = 859423 18 = 8927 3. 21 = 2978 30 = 43 60 = 9	6/21 = 2978 6/60 = 9 6/18 = 8927 6/30 = 43 6/15 = 859423	(One Miss Allowed Per Line) 6/12 = 563472	6/9 = 382457 6/7.5 = 674235 6/6 = 857432
Release Lens plunger			

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Form Re-order #5571

Continued on reverse side

TEST DESCRIPTION	UNACCEPTABLE	MARGINAL	ACCEPTABLE
PHORIA (Eye Co-ordination)	Dot Out of Box	Dot on Line	Dot in Box
DEPTH/SIGNS 1. NO RIGHT TURN 4. SCHOOL CROSSING 2. LEVEL CROSSING 5. SPEED LIMIT 3. GIVE WAY 6. NO OVERTAKING	NO DEPTH AWARENESS	EITHER NEAR FAR	BOTH NEAR FAR
Swich to "Nite" on the control panel for Test 7 & 8			
CONTRAST SENSITIVITY A B C 1. 10% = 958 20% = 479 30% = 863 2. 40% = 347 50% = 563 60% = 534 3. 70% = 426 80% = 728 90% = 962	90% = 962 70% = 426 80% = 728 60% = 534	50% = 563	40% = 347 30% = 863 20% = 479 10% = 958
GLARE RECOVERY	☐ Four or less correct	☐ Five correct	☐ Six or more correct
ROW 1. 2651439	2651439	2651439	2651439
ROW 2. 8294635	8294635	8294635	8294635
ROW 3. 6395274	6395274	6395274	6395274

VISUAL FIELD TEST

HORIZONTAL FIELD TEST	LEFT SIDE				RIGHT SIDE			
	☐ 85°	☐ 70°	☐ 55°	☐ NASAL	☐ NASAL	☐ 55°	☐ 70°	☐ 85°
VERTICAL FIELD TEST	UPPER		LOWER					
	☐ 35° L	☐ 35° R	☐ 35° L	☐ 35° R				

SNELLEN EQUIVALENTS

20/20	=	6/6
20/25	=	6/7.5
20/30	=	6/9
20/40	=	6/12
20/50	=	6/15
20/60	=	6/18
20/70	=	6/21
20/100	=	6/30
20/200	=	6/60

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Form Re-order #5571

Result:

1. Acuity:
    a. Right Eye:
    b. Left Eye:
2. Night Acuity:
3. Acuity Binocular Vision Test:
4. Intermediate Acuity:
    a. Right Eye:
    b. Left Eye:
5. Colour Perception:
6. Phoria:
7. Depth Perception:
8. Contrast Sensitivity:
9. Glare Recovery:
10. Field of Vision:
    a. Horizontal Angle:
    b. Vertical Angle:

Inference:

Date: **Signature of TA**

2. SPOT SPEED STUDY

Aim:

Equipment:

Theory:

Procedure:

Observations:

Location:	
Name of Road:	
Direction:	

Date:	
Trap Length:	
Weather: (Sunny/Rainy/Windy)	

Title: Spot Speed Using Enoscope

Sl. No.	Two Wheeler		Three Wheeler		Car		LCV		HCV	
	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)

Location:	
Name of Road:	
Direction:	

Date:	
Trap Length:	
Weather: (Sunny/Rainy/Windy)	

Title: Spot Speed Using Enoscope

Sl. No.	Two Wheeler		Three Wheeler		Car		LCV		HCV	
	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)	Time (Sec.)	Speed (km/hr)

Location:	
Name of Road:	
Direction:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

Title: Spot Speed Using Radar Gun

Sl. No.	Two Wheeler Speed (km/hr)	Three Wheeler Speed (km/hr)	Car Speed (km/hr)	LCV Speed (km/hr)	HCV Speed (km/hr)

Location:	
Name of Road:	
Direction:	

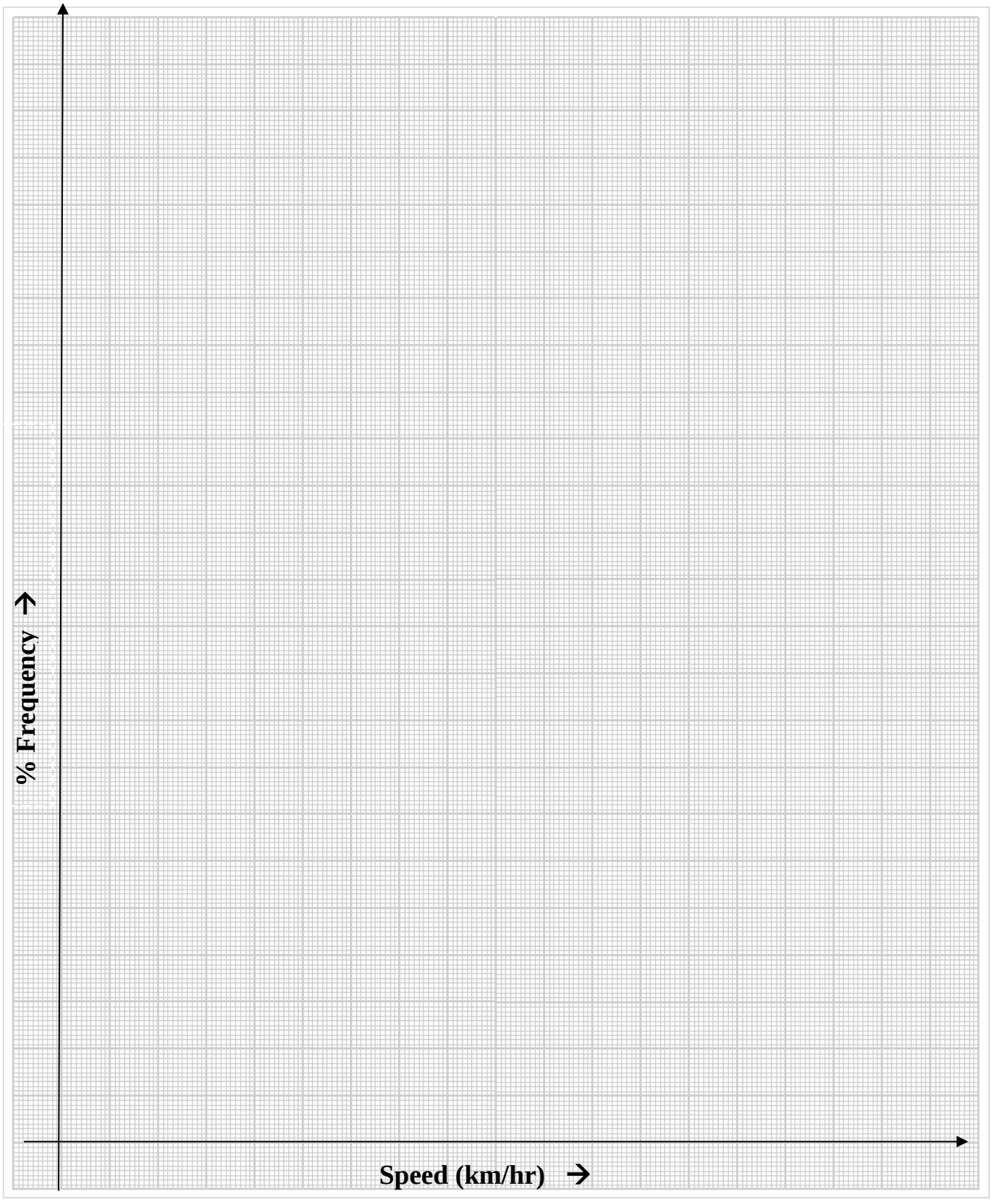
Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

Title: Spot Speed Using Radar Gun

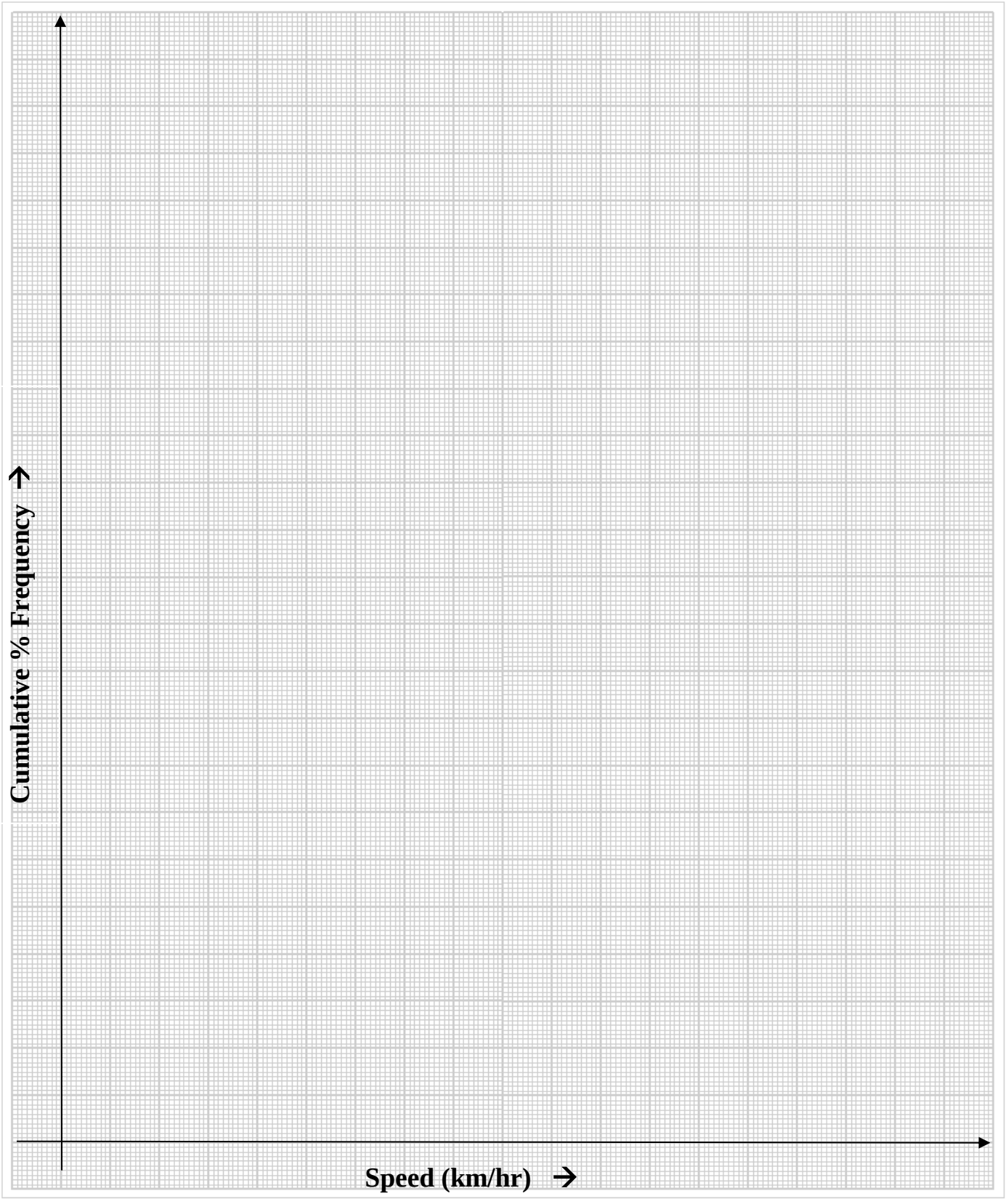
Sl. No.	Two Wheeler Speed (km/hr)	Three Wheeler Speed (km/hr)	Car Speed (km/hr)	LCV Speed (km/hr)	HCV Speed (km/hr)

Analysis:

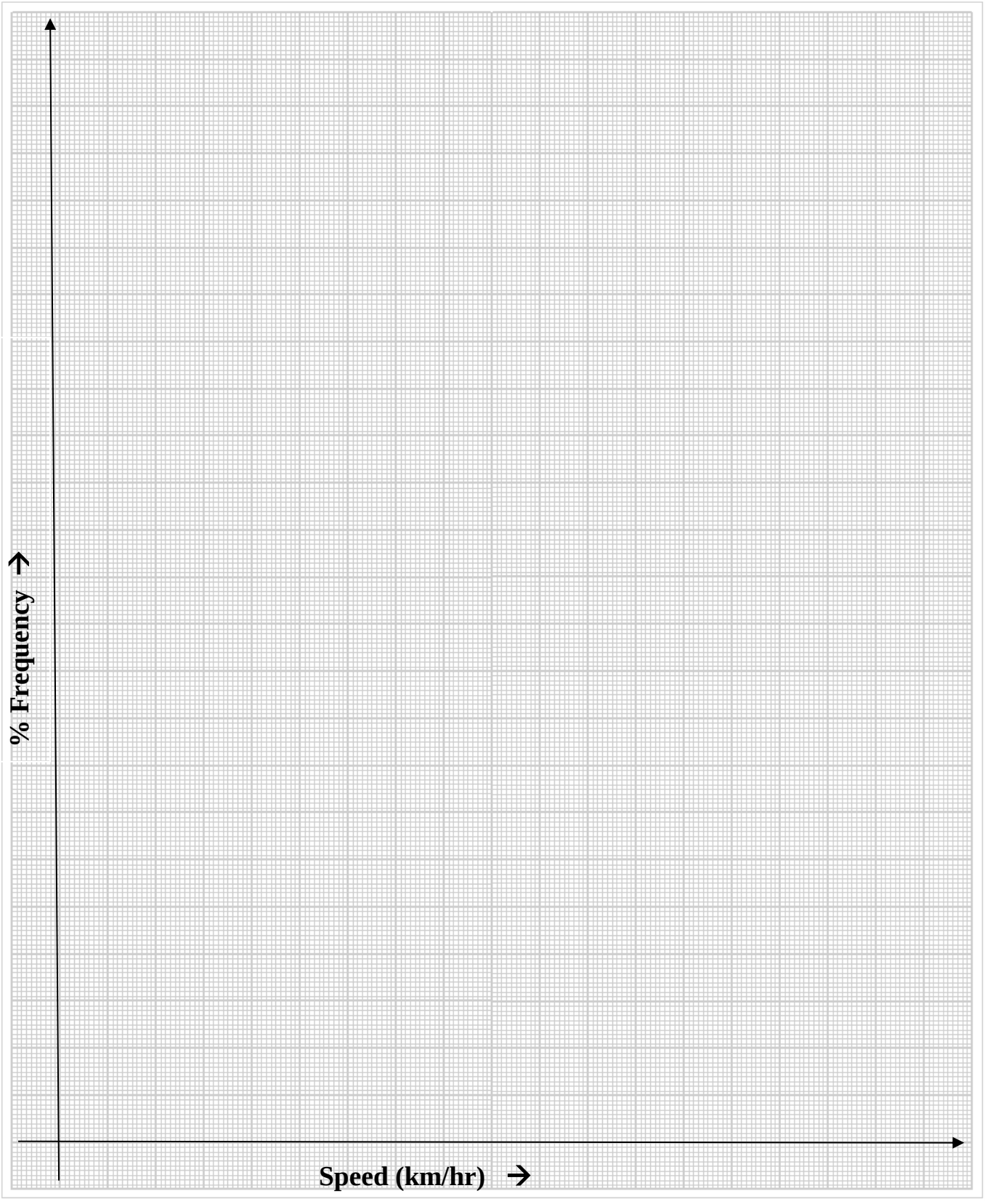
Title:																				
Speed Range	Mid-Speed	Two Wheeler			Three Wheeler			Car			LCV			HCV			All Vehicles		
		Frequency	% Frequency	Cumulative % Frequency	Frequency	% Frequency	Cumulative % Frequency	Frequency	% Frequency	Cumulative % Frequency	Frequency	% Frequency	Cumulative % Frequency	Frequency	% Frequency	Cumulative % Frequency	Frequency	% Frequency	Cumulative % Frequency



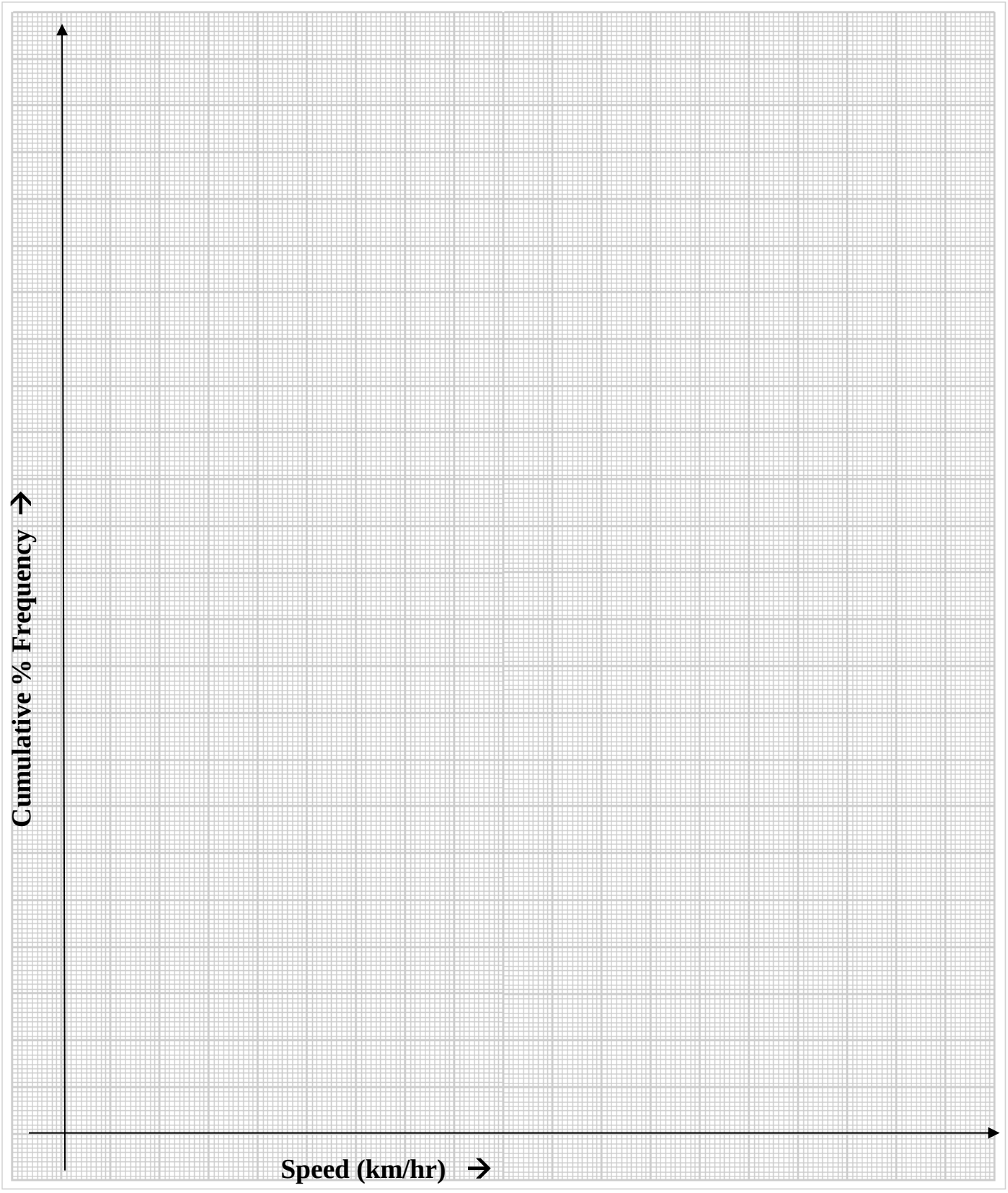
Graph Title: Speed v/s Percentage (%) Frequency for two wheelers



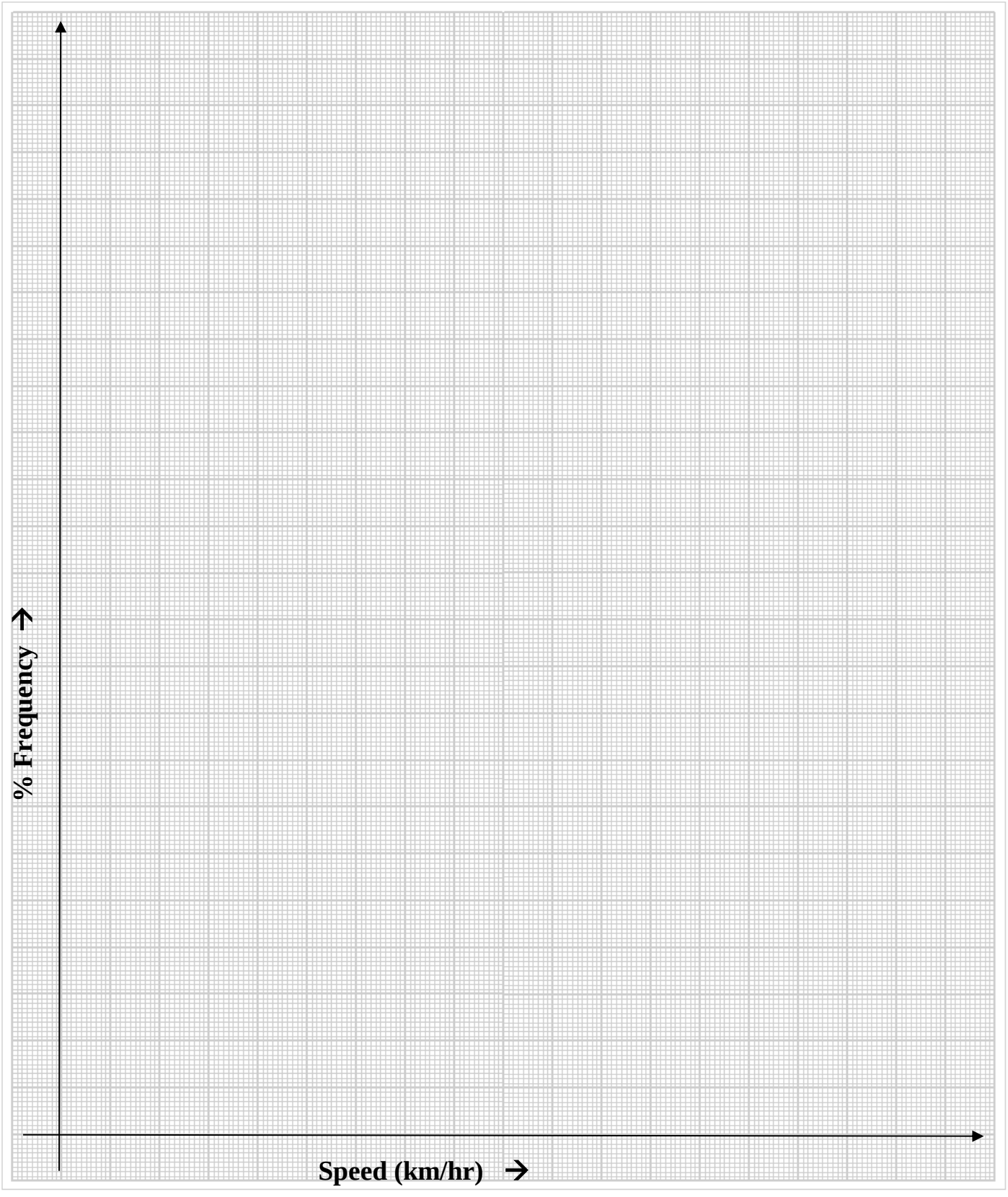
Graph Title: Speed v/s Cumulative % Frequency for two wheelers



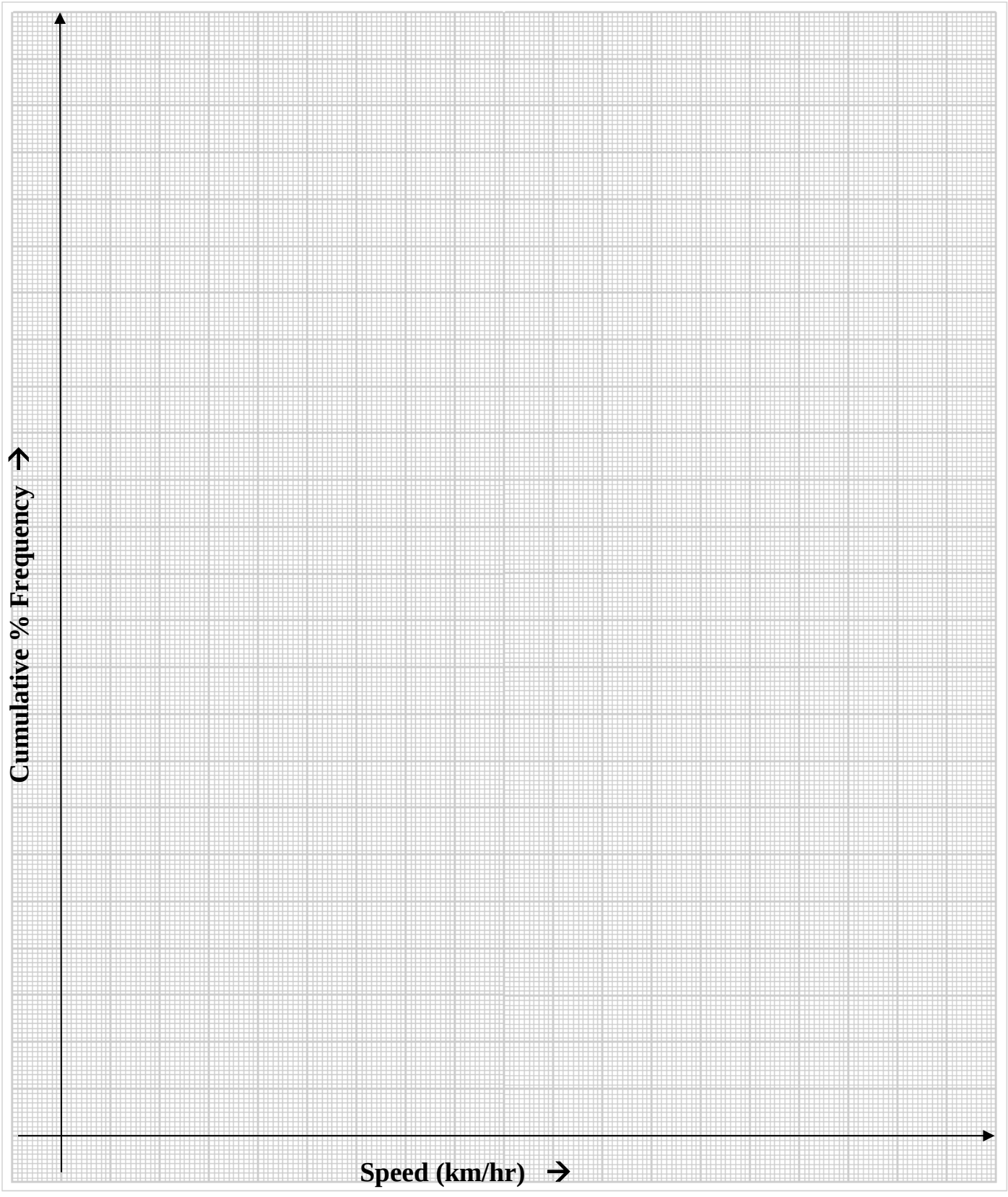
Graph Title: Speed v/s Percentage (%) Frequency for three wheelers



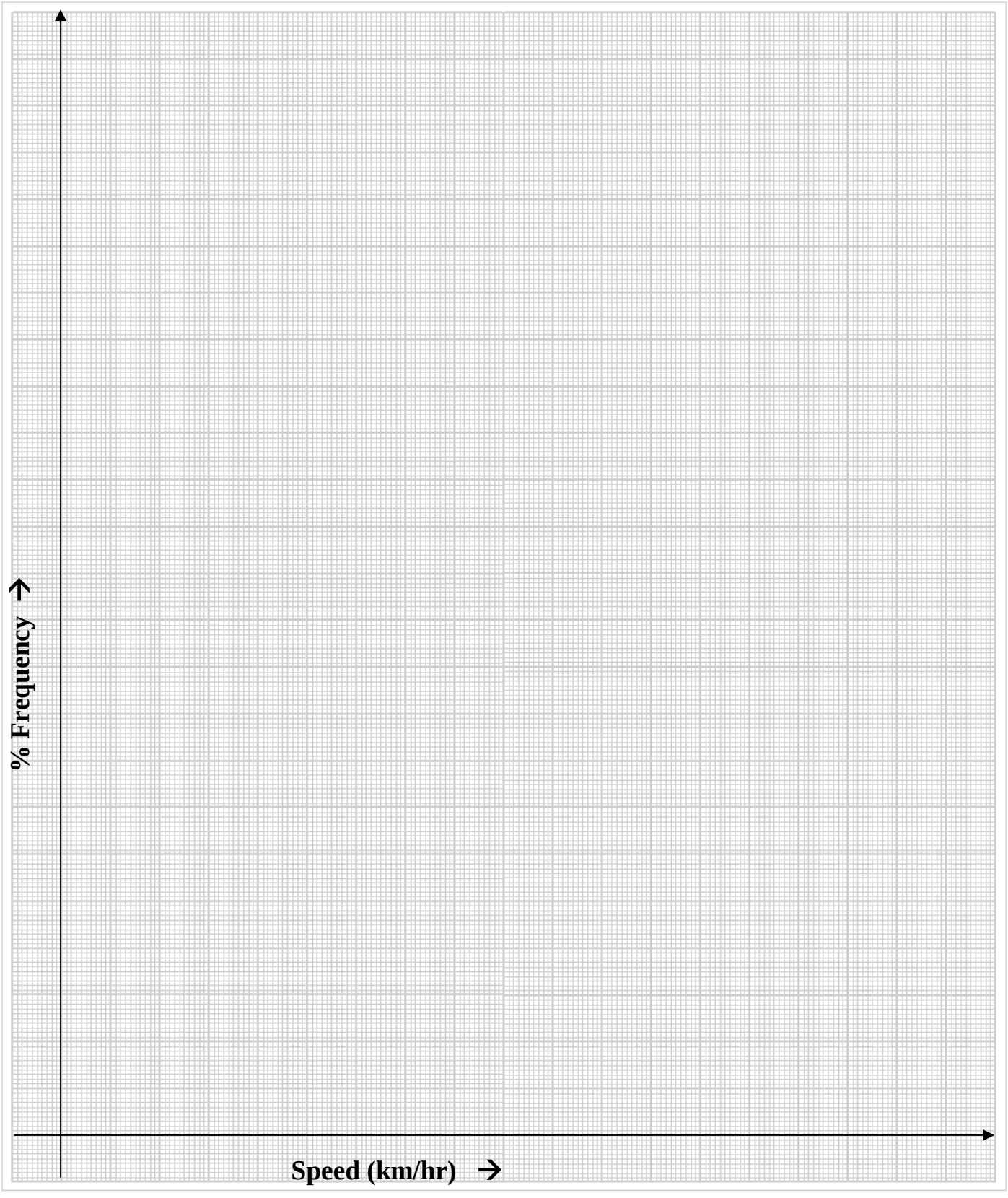
Graph Title: Speed v/s Cumulative % Frequency for three wheelers



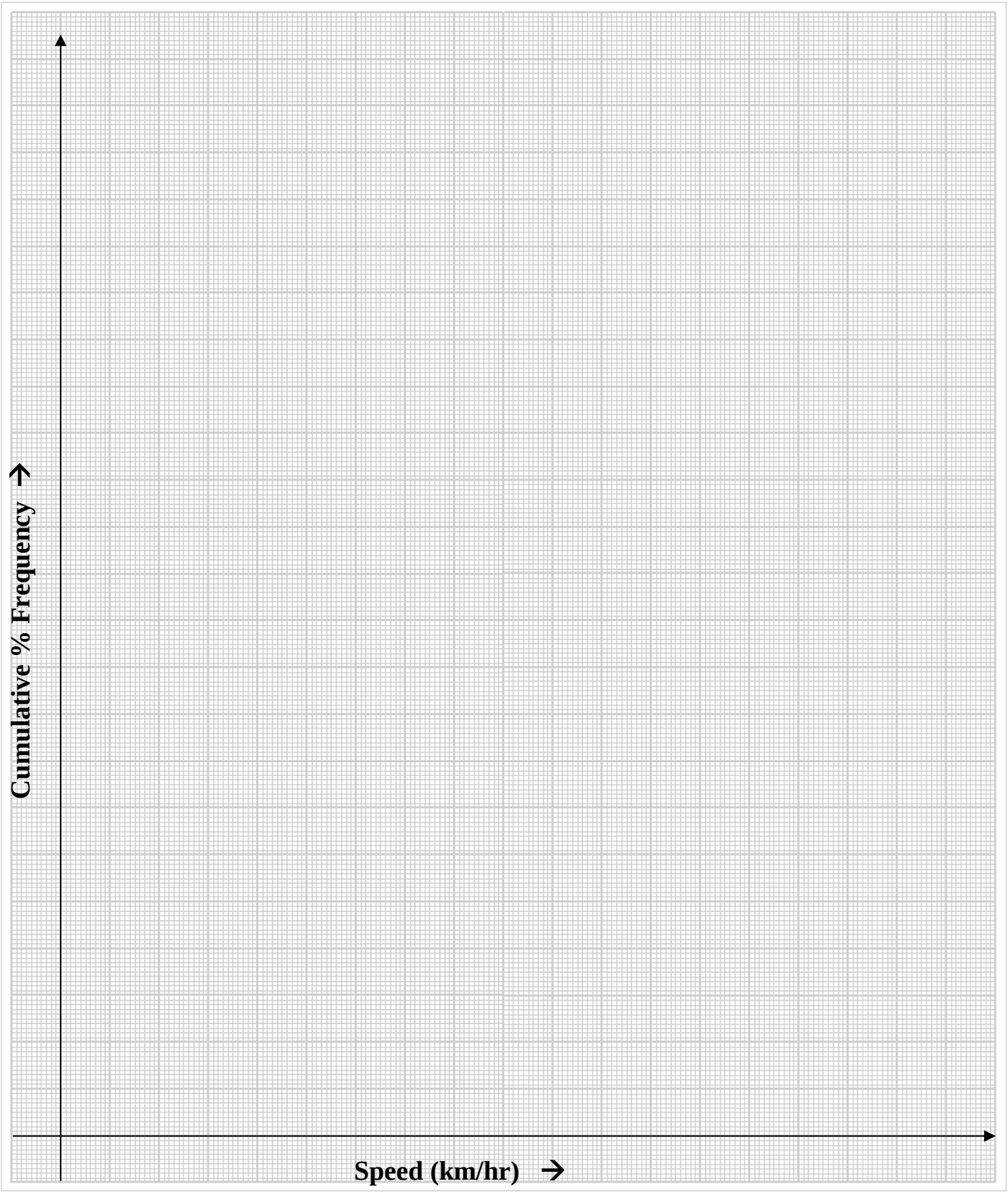
Graph Title: Speed v/s Percentage (%) Frequency for Car



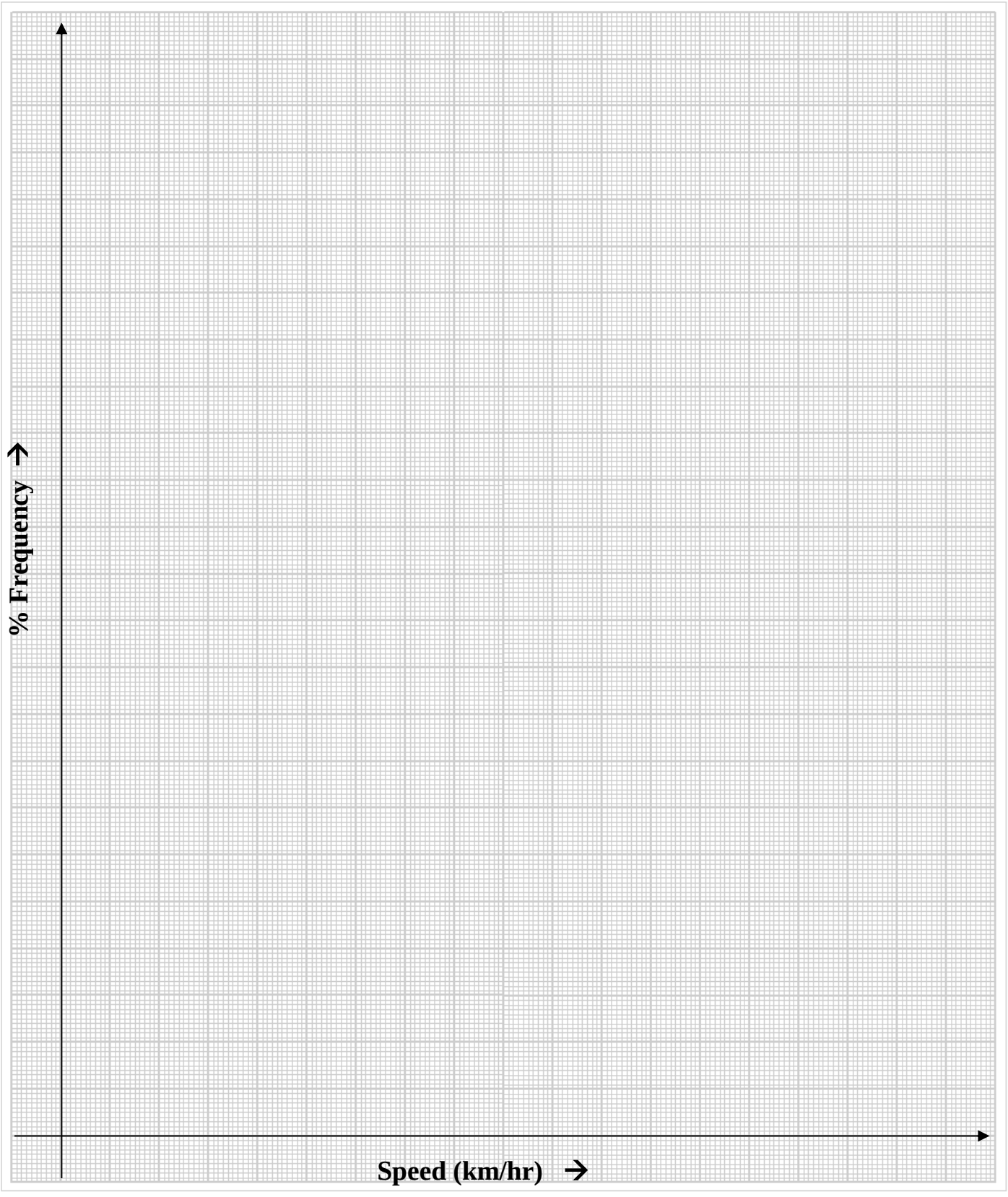
Graph Title: Speed v/s Cumulative % Frequency for Car



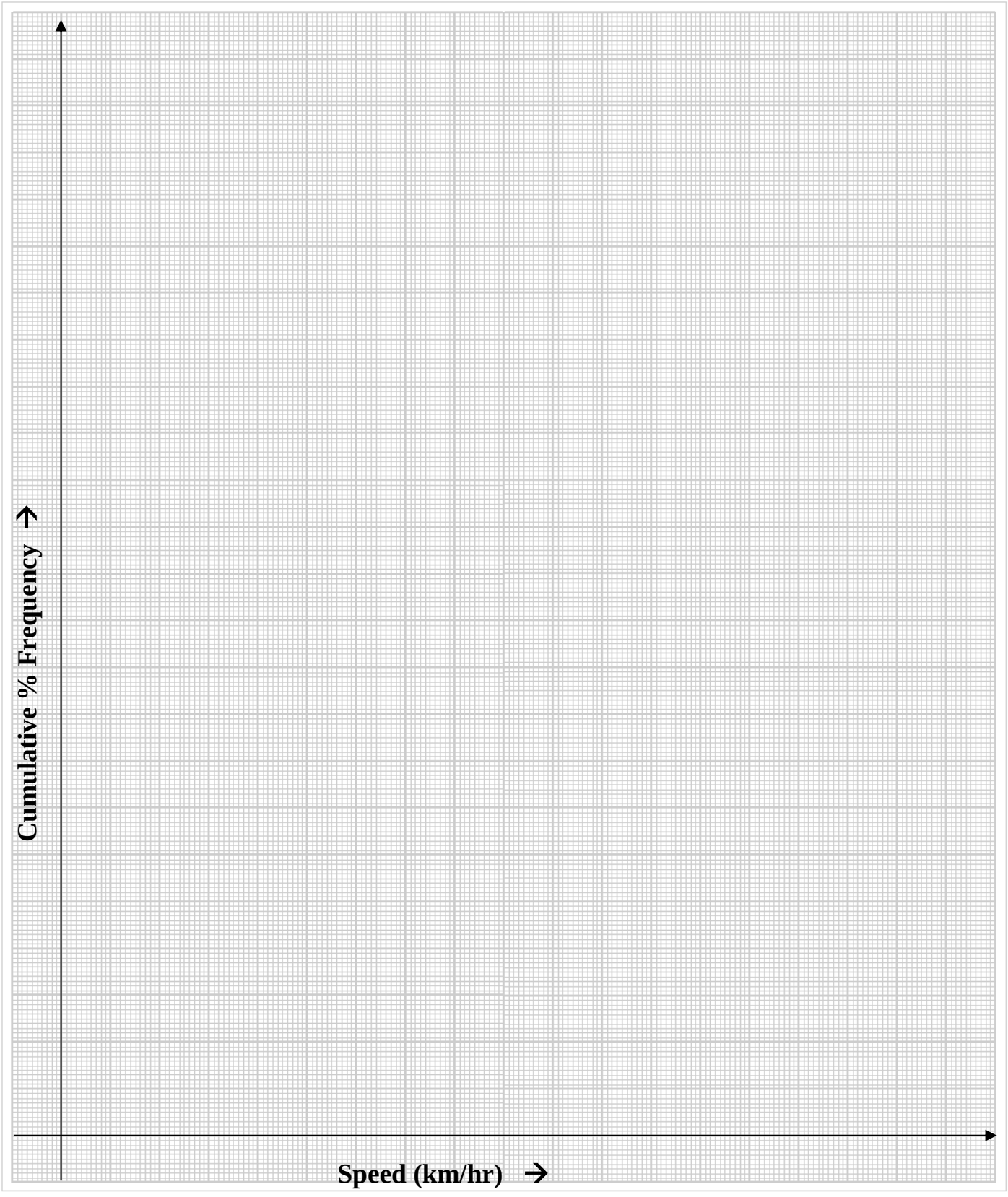
Graph Title: Speed v/s Percentage (%) Frequency for LCV



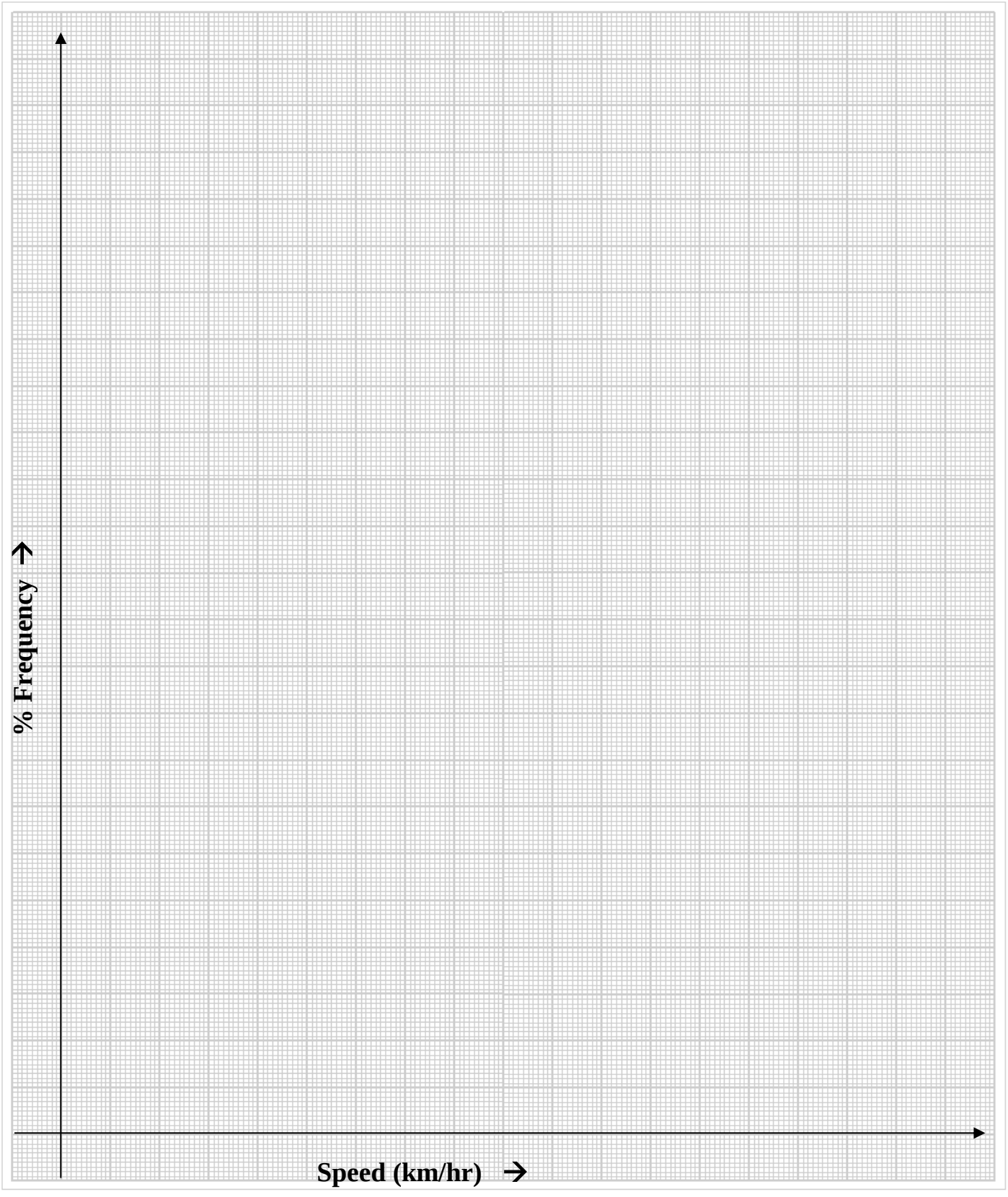
Graph Title: Speed v/s Cumulative Percentage (%) Frequency for LCV



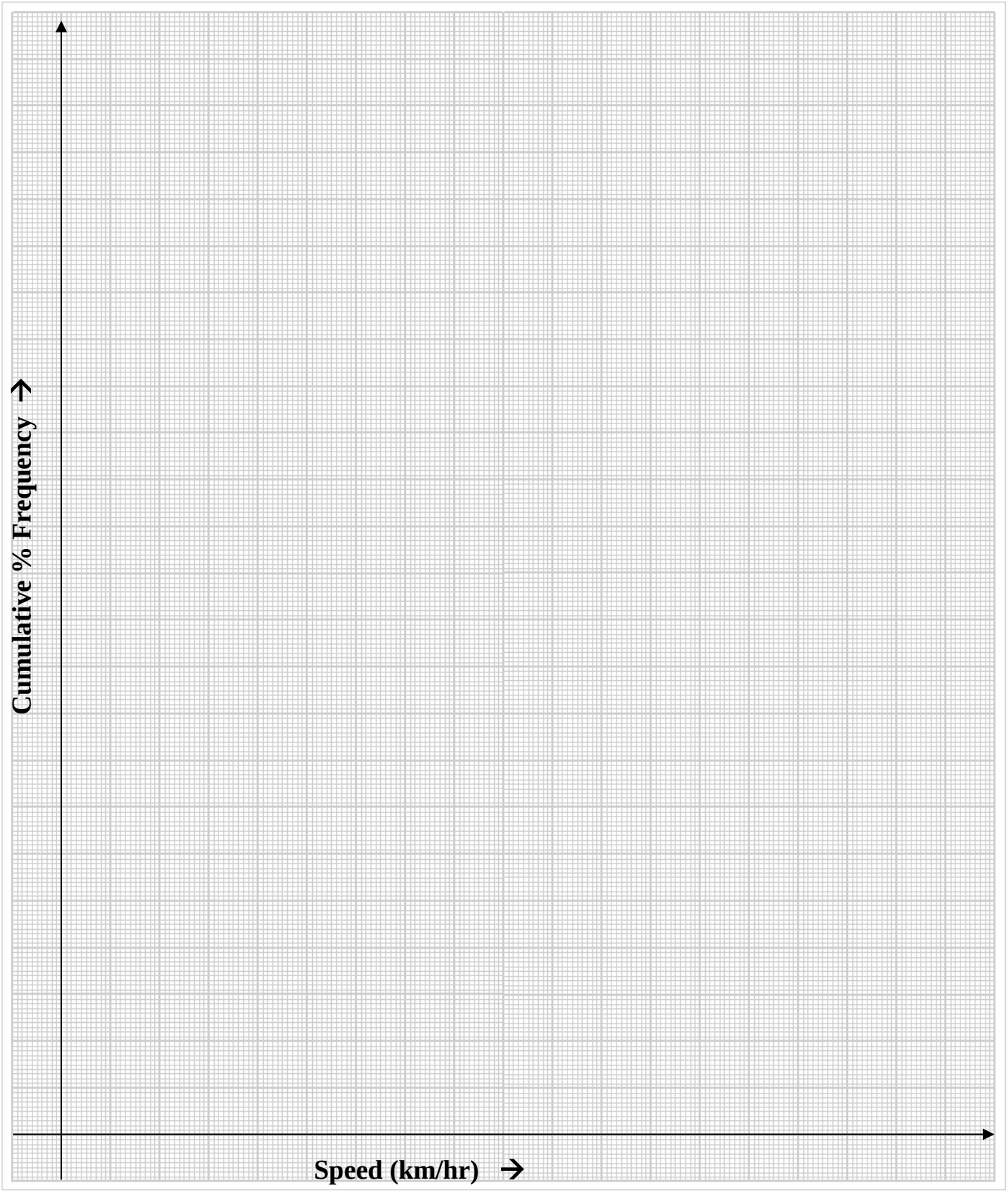
Graph Title: Speed v/s Percentage (%) Frequency for HCV



Graph Title: Speed v/s Cumulative Percentage (%) Frequency for HCV



Graph Title: Speed v/s Percentage (%) Frequency for All vehicle type



Graph Title: Speed v/s Cumulative % Frequency for All vehicle type

Sample Calculations:

Vehicle Class: _____

1. Mean =

2. Mode =

3. 15^{th} Percentile Speed =

4. 85^{th} Percentile Speed =

5. 95^{th} Percentile Speed =

6. Standard deviation =

7. Standard Error of Mean =

8. Required Sample Size (for 95% Confidence Level)=

Result:

	Two Wheeler	Three Wheeler	Car	LCV	HCV
Mean (kmph)					
Median (kmph)					
15^{th} Percentile Speed					
85^{th} Percentile Speed					
95^{th} Percentile Speed					
Standard Error of Mean					
Sample Size Required (95% confidence level)					

Inference:

Date: **Signature of TA**

3. MEASUREMENT OF TRAVEL TIME AND DELAY FOR CONGESTED CORRIDOR

Aim:

Equipment:

Theory:

Procedure:

Calculations (Direction 1): From …… To ……

Calculations (Direction 2): From …… To ……

Observations:

Travel Time and Delay Measurement Study for a corridor (Onwards)

Location:		**Date:**	
Name of Road:		**Name of Observer:**	
Length of Road stretch:		**Weather:** (Sunny/Rainy/Windy)	
Starting Point:		**End Point:**	
Starting Time:		**End Time:**	

No. of stop	Duration (sec)	Cause (code)	Type of Intersection (M/N)

Codes:

TS: Traffic Signal **P**: Parking **LT**: Left Turn **UC**: Uncontrolled Intersection

PC: Pedestrian **IN**: Incident **B**: Bus stop **C**: Congestion

O: Other **M**: Major **N**: Normal

Travel Time and Delay Measurement Study for a corridor (Return)

Location:		**Date:**	
Name of Road:		**Name of Observer:**	
Length of Road stretch:		**Weather:** (Sunny/Rainy/Windy)	
Starting Point:		**End Point:**	
Starting Time:		**End Time:**	

No. of stop	Duration (sec)	Cause (code)	Type of Intersection (M/N)

For GPS Graph Sticking

GPS Data

	Onwards		Return	
	Start Point	**End Point**	**Start Point**	**End Point**
Latitude				
Longitude				
Altitude				
Time				

Result:

Sl. No.		Onward	Return
1.	Total delay (s)		
2.	Delay due to Traffic Signals (s)		
3.	Congestion Delay (s)		
4.	Travel Time (min)		
5.	Average Speed (km/hr)		
6.	Running Speed (km/hr)		
7.	LOS for corridor (HCM 2000)		
8.	LOS for Intersection (HCM 2000)		

Inference:

Date: **Signature of TA**

4. MOVING OBSERVER METHOD STUDY

Aim:

Equipment:

Theory:

Procedure:

Observations:

Location:		**Date:**	
Name of Road:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	
Distance:		**Time:**	

Sl. No.	**m_a / m_o / m_p**					**t_a (sec)**	**t_w (sec)**
	2W	**3W**	**Car**	**LCV**	**HCV**		

Location:		**Date:**	
Name of Road:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	
Distance:		**Time:**	

Sl. No.	**m_a / m_o / m_p**					**t_a (sec)**	**t_w (sec)**
	2W	**3W**	**Car**	**LCV**	**HCV**		

Moving Observer Method Consolidated Datasheet

Location:		**Date:**	
Name of Road:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	
Distance:		**Time:**	

Sl. No.	m_a					m_o					m_p					t_a (sec)	t_w (sec)
	2W	**3W**	**Car**	**LCV**	**HCV**	**2W**	**3W**	**Car**	**LCV**	**HCV**	**2W**	**3W**	**Car**	**LCV**	**HCV**		

Location:	
Name of Road:	
Direction:	
Distance:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	
Time:	

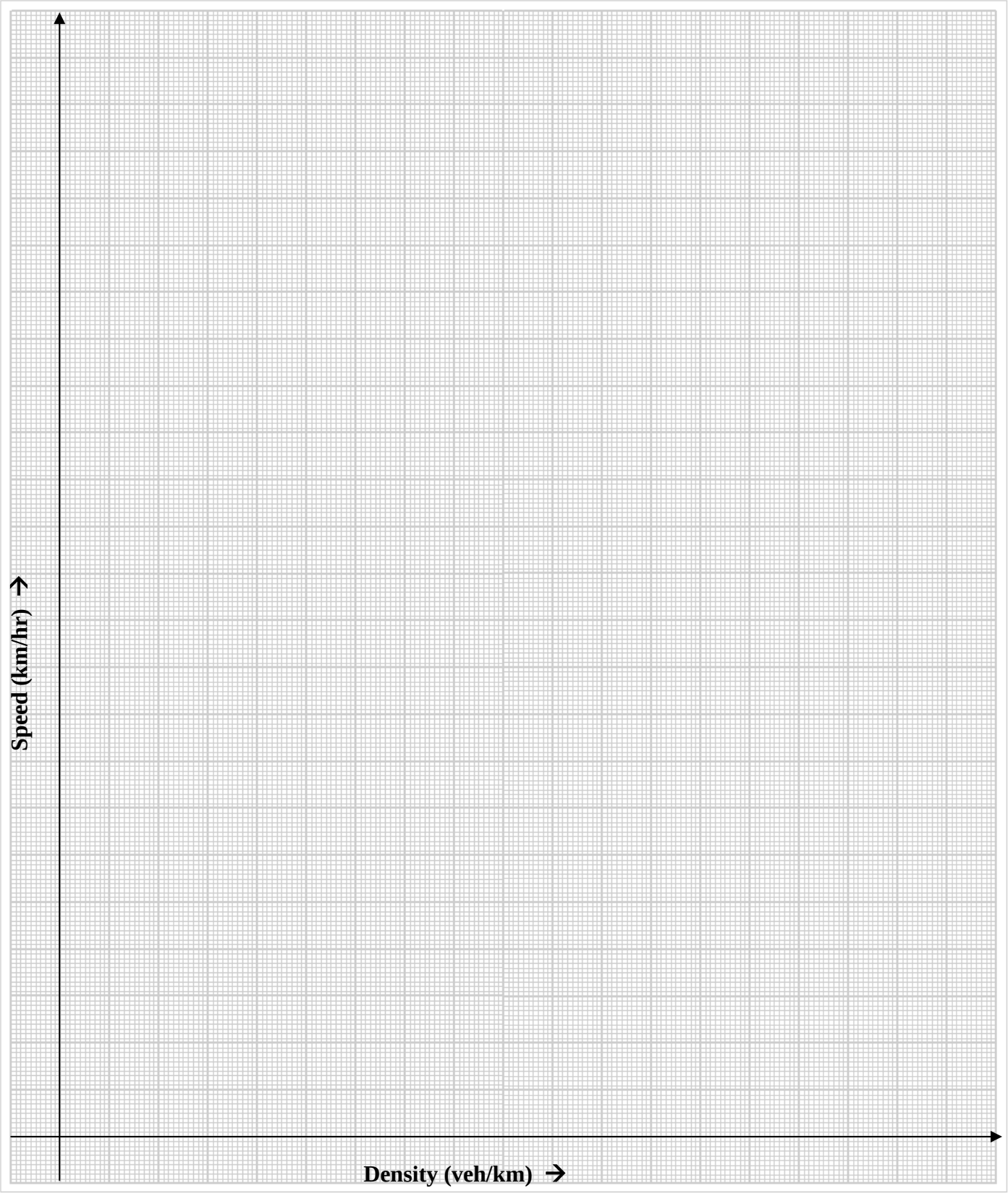
Sl. No.	m_a					m_o					m_p					t_a	t_w
	2W	**3W**	**Car**	**LCV**	**HCV**	**2W**	**3W**	**Car**	**LCV**	**HCV**	**2W**	**3W**	**Car**	**LCV**	**HCV**		

Calculations:

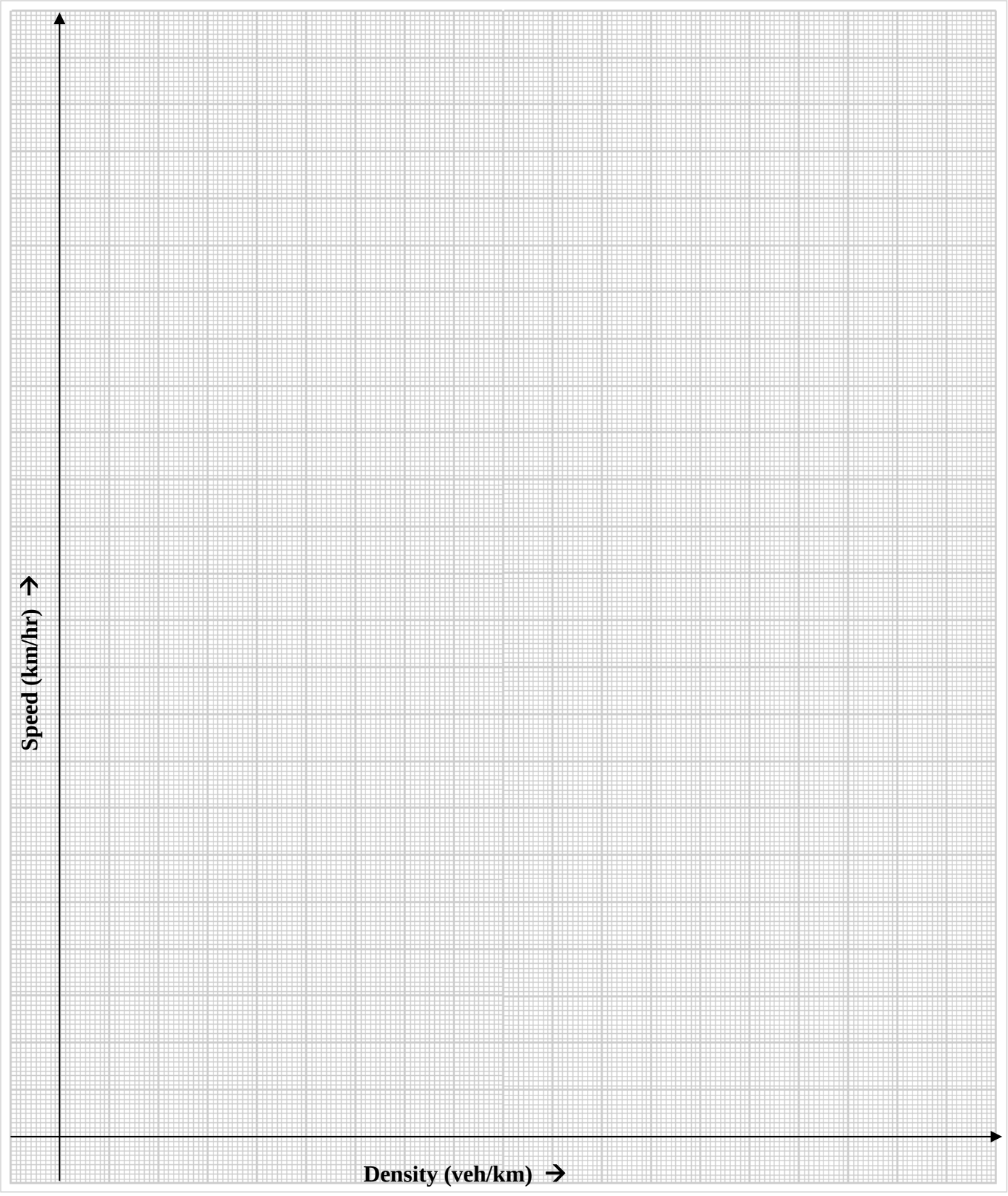
Vehicle Class	2W	3W	Car	LCV	HCV
PCU					

Direction:									
Sample No.	m_a	m_o	m_p	$m_a = (m_o - m_p)$	t_a (hr)	t_w (hr)	Q (veh/hr)	V (km/hr)	K (veh/km)

Direction:									
Sample No.	m_a	m_o	m_p	$m_a = (m_o - m_p)$	t_a (hr)	t_w (hr)	Q (veh/hr)	V (km/hr)	K (veh/km)



Graph Title: Speed vs Density relation for the direction _____



Graph Title: Speed vs Density relation for the direction _____

Sample Calculation:

Calibration of Greenshield's Model:

a) Direction 1: From ……..…… To ……

x_i	y_i	$(x_i - \dot{x})$	$(y_i - \dot{y})$	$(x_i - \dot{x})(y_i - \dot{y})$	$(x_i - \dot{x})\ (x_i - \dot{x})$
				∑=	∑=

b) **Direction 2:** From ……..…… To ……

x_i	y_i	$(x_i - \dot{x})$	$(y_i - \dot{y})$	$(x_i - \dot{x})(y_i - \dot{y})$	$(x_i - \dot{x})(x_i - \dot{x})$
				∑=	∑=

Results:

Direction	Jam Density, k_j	Free Flow Speed, v_f	Maximum Flow, Q_{max}

Inference:

Date: **Signature of TA**

5. LICENSE PLATE METHOD OF OD SURVEY

Aim:

Equipment:

Theory:

Procedure:

Sketch of Study Area:

	Zone No.	Name

Observations:

Name of Loaction:		**Date:**	
Name of Observer:		**Weather:** (Sunny/Rainy/Windy)	

Sketch of location:

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Zone Number:	Zone Name:

Direction:	
Time	**License Plate Number**

Direction:	
Time	**License Plate Number**

Sample Calculation:

Result:

OD Matrix of Study Area:

O\D	1	2	3	4	5	6	∑P
1							
2							
3							
4							
5							
6							
∑A							

Inference:

Date: **Signature of TA**

6. PARKING USAGE SURVEY

Aim:

Equipment:

Theory:

Procedure:

Sketch of Study Area:

Observations:

Data Sheet for Parking Usage Study

Location:		**Date:**	
Time:		**Name of Observer:**	
Type of Parking:		**Weather:** (Sunny/Rainy/Windy)	
Type of Vehicles Parked:		**Frequency of Patrol:**	

Bay No.	**Registration Number of Vehicles Parked at the Time of Patrol**											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Calculations:

Parking Occupancy

Bay No.	Time												Turn - over
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
Accumulation													
Occupancy													

(1) Parking Volume =

(2) Parking Capacity =

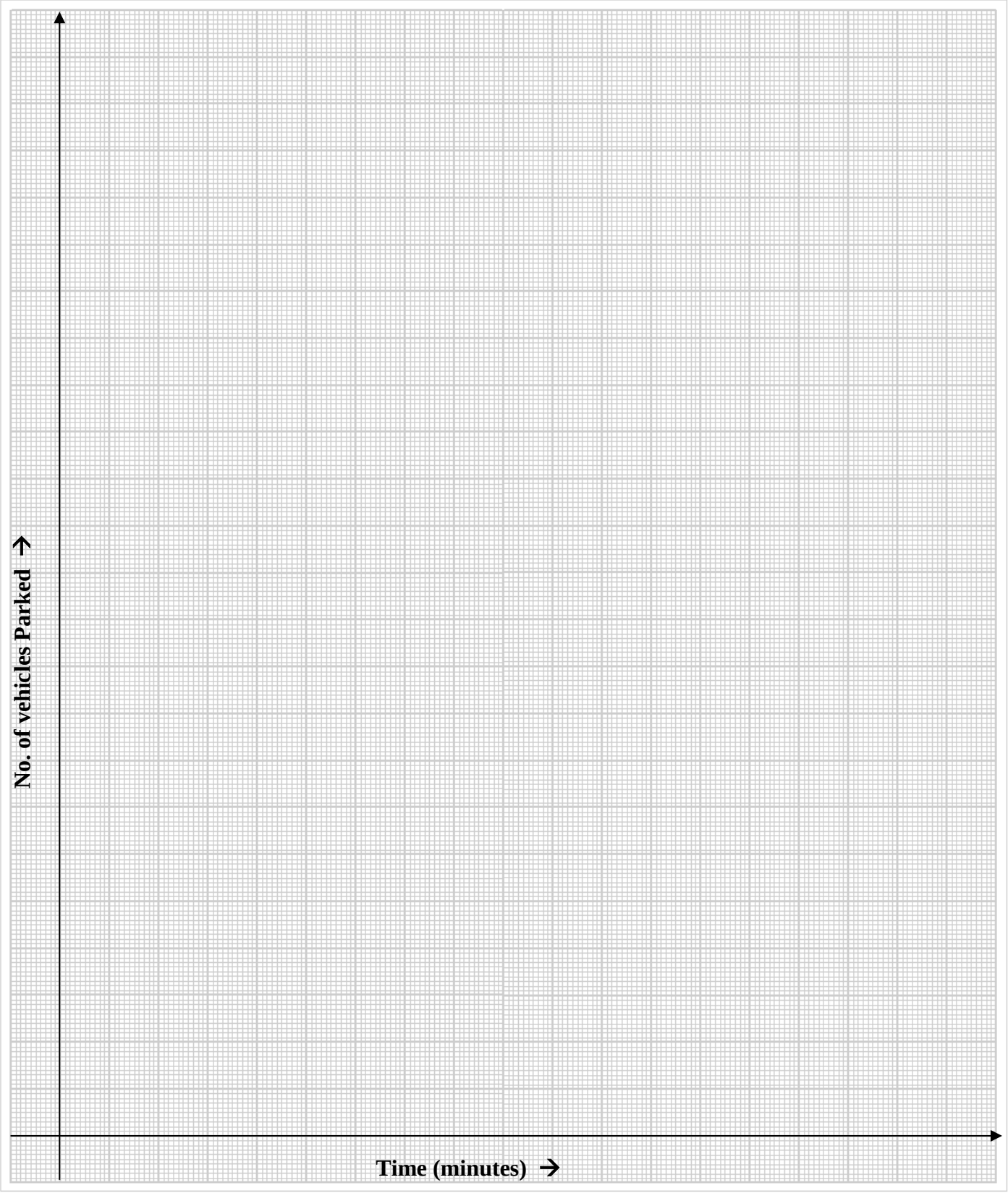
(3) Parking Load =

(4)Parking Index =

(5) Parking Duration =

(6) Parking Turnover =

(7) Average Parking Occupancy =



Graph Title: Parking Accumulation Curve

Result:

1. Parking Volume =
2. Parking Load =
3. Parking Index =
4. Parking Turnover =
5. Average Occupancy =
6. Average Parking Duration =

Inference:

Date: **Signature of TA**

7. ACCELERATION AND DECELERATION CHARACTERISTICS OF VEHICLES

Aim:

Equipment:

Theory:

Procedure:

Observations:

Observation table for acceleration-deceleration using stopwatch

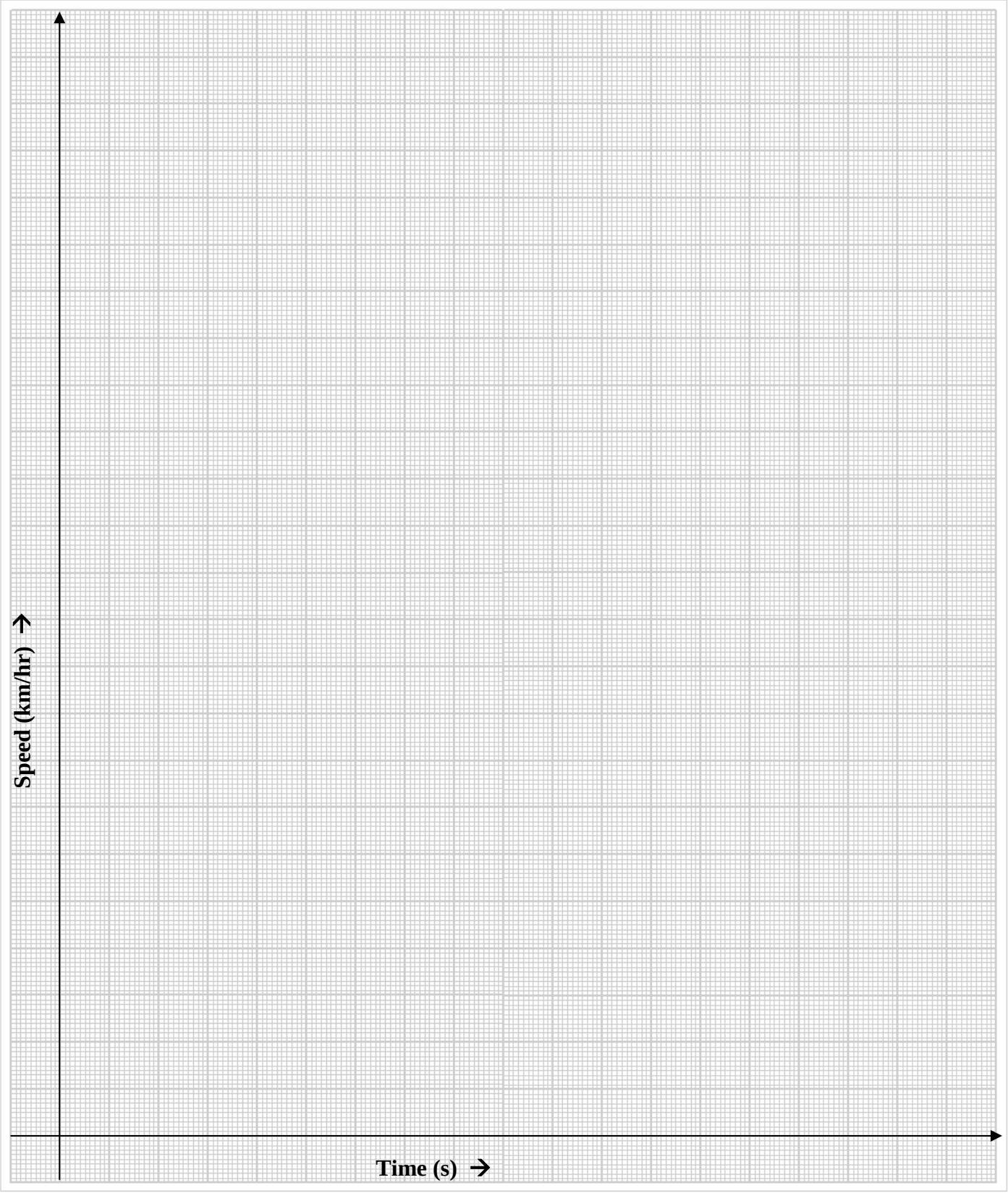
Speed (km/h)	Run 1		Run 2		Run 3		Run 4	
	Time for Acceleration (s)	Time for Deceleration (s)	Time for Acceleration (s)	Time for Deceleration (s)	Time for Acceleration (s)	Time for Deceleration (s)	Time for Acceleration (s)	Time for Deceleration (s)
0								
20								
40								
60								
80								

Observation table for acceleration-deceleration using V-Box

Speed (km/h)	**Time for Acceleration (s)**	**Time for Deceleration (s)**
0		
10		
20		
30		
40		
50		
60		
70		
80		

Calculations:

V Box Plot:



Graph Title: Speed profiles of subject vehicle in different runs

Result:

Run No	Average Acceleration Rate (m/s^2)	Average Deceleration Rate (m/s^2)
1		
2		
3		
V Box		

Inference:

Date: **Signature of TA**

8. INTERSECTION VOLUME STUDY

Aim:

Equipment:

Theory:

Procedure:

Sketch of Study Area:

Observations:

Name of Intersection:	
Name of Approach:	
Direction:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**
From	**To**					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Name of Intersection:	
Name of Approach:	
Direction:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**
From	**To**					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Name of Intersection:	
Name of Approach:	
Direction:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**
From	**To**					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Time		Two Wheeler	Three Wheeler	Car	LCV	HCV
From	To					

Observation Table for PCU Estimation:

Title: Clearance Time in seconds for Various Vehicles Types					
Sl. No.	**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**
1					
2					
3					
4					
5					
Average Clearance Time (sec)					
Average Area (m^2)	1.2	4.48	5.39	12.81	17.62
PCU					

Calculations:

a) Sample Calculations for PCU Estimation:

b) PHF Estimation:

Time Interval		**Volume (PCU)**	**Hourly Volume (PCU in 1 hr)**	**PHF Calculations**
From	**To**			
				Peak Volume for ____ min Interval during peak hour, V_n =
				Peak Volume in 1 Hour, V_{60} =
				Number of ____ minute intervals in 1 hour, n =
				PHF =

Traffic Volume for the Selected Approach:

Location:	
Name of Intersection:	

Date:	
Name of Observer:	
Weather: (Sunny/Rainy/Windy)	

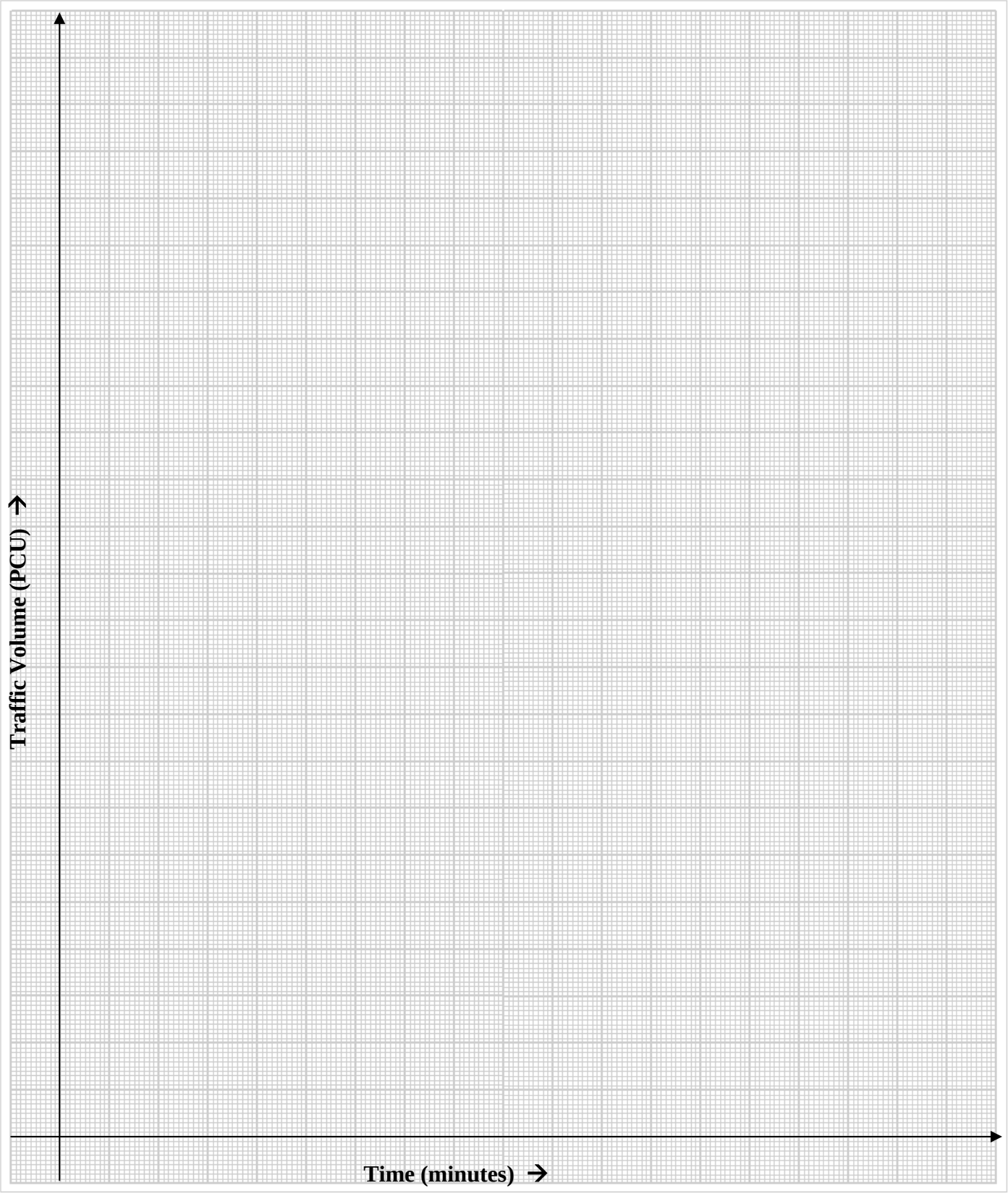
Name of Approach:							
Direction:							
Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**	**Total PCU**
From	**To**						

Name of Approach:							
Direction:							
Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**	**Total PCU**
From	**To**						

Name of Approach:							
Direction:							
Time		**Two Wheeler**	**Three Wheeler**	**Car**	**LCV**	**HCV**	**Total PCU**
From	**To**						

Traffic Volume on the Observed Intersection in PCU:

Time		Volume in Each Direction												Total Intersection Volume
From	To	Left	Straight	Right	Left	Straight	Right	Left	Straight	Right	Left	Straight	Right	



Graph Title: Volume Vs Time Plot

Result:

Vehicle Type	2W	3W	Car	LCV	HCV
PCU					

Inference:

Date: **Signature of TA**

9. SATURATION FLOW MEASUREMENT

Aim:

Equipment:

Theory:

Procedure:

1. **HCM Method:**

2. TRL Method:

Observations:

1. Saturation Flow by HCM Method:

Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	

Cycle Time	Two Wheeler	Three Wheeler	Car	HCV	LCV	Time when 4th vehicle crosses (T_4)	Time when 8th vehicle crosses (T_8)	Time when last vehicle crosses (T_n)
1								
2								
3								
4								

5								
6								
7								
8								
9								
10								

2. Saturation Flow by TRL Method:

Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
1							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
2							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
3							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
4							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
5							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
6							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
7							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
8							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
9							

Cycle No.	Time (sec)		2W	3W	Car	LCV	HCV
	From	To					
10							

Sample Calculations:

1. HCM 2010 Method:

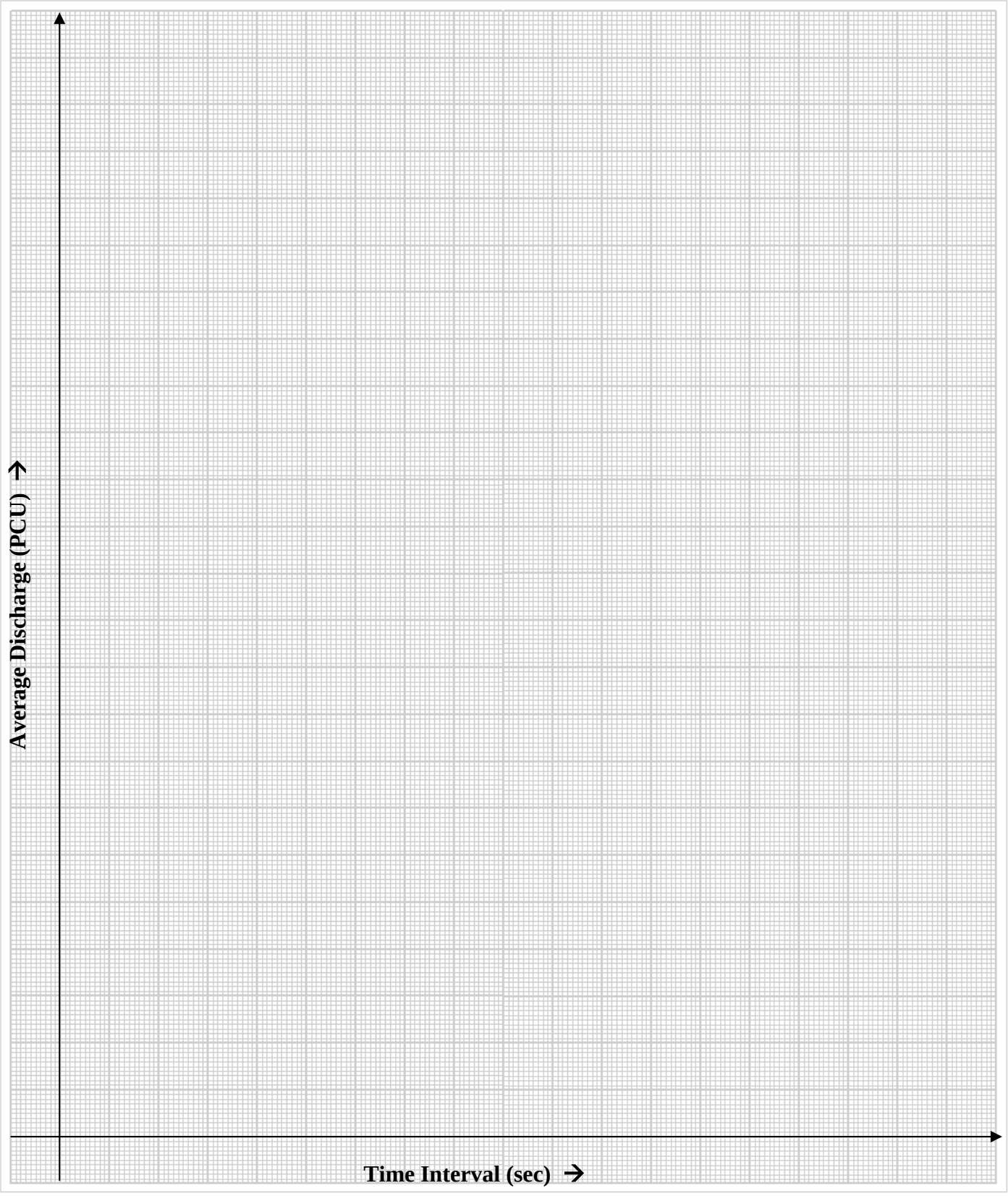
2W	3W	Cars	LCV	HCV	Total No: of vehicle discharged in PCU, N	Period of discharge (sec), $T = T_n - T_4$	Saturation flow (PCU/hr) $S = 3600/h = 3600*N/T$

2. TRL Method:

Time (sec)		Total Vehicle (PCU)	Cumulative No. of Vehicle (PCU)
From	To		

Analysis:

Title: Average Flow Values (TRL Method)								
Cycle No.	**Time (sec)**		**2W**	**3W**	**Car**	**LCV**	**HCV**	**PCU**
	From	**To**						



Graph Title: Average discharge vs Time Curve (TRL Method)

Results:

1. Saturation Flow by HCM 2010 Method:

2. Saturation Flow by TRL Method:

Inference:

Date: **Signature of TA**

10. INTERSECTION DELAY MEASUREMENT

Aim:

Equipment:

Theory:

Procedure:

Observations: Approach -A

Site Information		General Information	
Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Initial Input parameters			
Number of Lanes		**Cycle length**	
Free-Flow Speed(km/h)		**Survey Count Interval(s)**	

Title:																					
Clock Time	**Cycle No.**	**Number of vehicles stopped in the approach**																		**Number of stopped vehicles**	**Number of non-stopped vehicles**
		Count Interval																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**		
	1																						
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						

Title:																							
Clock Time	Cycle No.	Number of vehicles stopped in the approach																				Number of stopped vehicles	Number of non-stopped vehicles
		Count Interval																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	9																						
	10																						
	11																						
	12																						
	13																						
	14																						
	15																						
	Total																						

Computation			
Total vehicle in queue:		**Fraction of vehicle stopping:**	
Time in queue (Per Veh.):		**Acc./Dece. Correction delay:**	
No. of vehicle stopping per lane per cycle:		**Control delay/ vehicle for approach**	
Acc./Dece. Correction Factor:			

Observations: Approach -B

Site Information		General Information	
Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Initial Input parameters			
Number of Lanes		**Cycle length**	
Free-Flow Speed(km/h)		**Survey Count Interval(s)**	

Title:																					
Clock Time	**Cycle No.**	**Number of vehicles stopped in the approach**																		**Number of stopped vehicles**	**Number of non-stopped vehicles**
		Count Interval																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**		
	1																						
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						

Title:																							
Clock Time	Cycle No.	Number of vehicles stopped in the approach																				Number of stopped vehicles	Number of non-stopped vehicles
		Count Interval																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	9																						
	10																						
	11																						
	12																						
	13																						
	14																						
	15																						
	Total																						

Computation			
Total vehicle in queue:		**Fraction of vehicle stopping:**	
Time in queue (Per Veh.):		**Acc./Dece. Correction delay:**	
No. of vehicle stopping per lane per cycle:		**Control delay/ vehicle for approach**	
Acc./Dece. Correction Factor:			

Observations: Approach - C

Site Information		General Information	
Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Initial Input parameters			
Number of Lanes		**Cycle length**	
Free-Flow Speed(km/h)		**Survey Count Interval(s)**	

Title:																					
Clock Time	**Cycle No.**	**Number of vehicles stopped in the approach**																		**Number of stopped vehicles**	**Number of non-stopped vehicles**
		Count Interval																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**		
	1																						
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						

Title:																							
Clock Time	Cycle No.	Number of vehicles stopped in the approach																				Number of stopped vehicles	Number of non-stopped vehicles
		Count Interval																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	9																						
	10																						
	11																						
	12																						
	13																						
	14																						
	15																						
	Total																						

Computation			
Total vehicle in queue:		**Fraction of vehicle stopping:**	
Time in queue (Per Veh.):		**Acc./Dece. Correction delay:**	
No. of vehicle stopping per lane per cycle:		**Control delay/ vehicle for approach**	
Acc./Dece. Correction Factor:			

Observations: Approach -D

Site Information		General Information	
Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Initial Input parameters			
Number of Lanes		**Cycle length**	
Free-Flow Speed(km/h)		**Survey Count Interval(s)**	

Title:																					
Clock Time	**Cycle No.**	**Number of vehicles stopped in the approach**																		**Number of stopped vehicles**	**Number of non-stopped vehicles**
		Count Interval																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**		
	1																						
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						

Title:																							
Clock Time	Cycle No.	Number of vehicles stopped in the approach																				Number of stopped vehicles	Number of non-stopped vehicles
		Count Interval																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	9																						
	10																						
	11																						
	12																						
	13																						
	14																						
	15																						
	Total																						

Computation			
Total vehicle in queue:		**Fraction of vehicle stopping:**	
Time in queue (Per Veh.):		**Acc./Dece. Correction delay:**	
No. of vehicle stopping per lane per cycle:		**Control delay/ vehicle for approach**	
Acc./Dece. Correction Factor:			

Calculation

Control Delay as per HCM 2000

Formulas

Control delay =

Average uniform delay =

Incremental delay =

Initial queue delay =

Table: Delay calculation

S. No.	Data	Approach A	Approach B	Approach C	Approach D
1	**g/c**				
2	**Saturation flow**				
3	**Lane Capacity**				
4	**Degree of saturation**				
5	**Analysis period**				
6	**Arrival type**				
7	**PF, k, *I***				
8	**Uniform Delay**				
9	**Increment Delay**				
10	**Initial queue Delay**				
11	**Control Delay**				

Total intersection delay:

From field =

From HCM 2000 =

Result:

Field	Approach A	Approach B	Approach C	Approach D	Intersection
Control delay					
LOS					
HCM 2000	**Approach A**	**Approach B**	**Approach C**	**Approach D**	**Intersection**
Control delay					
LOS					

Inference:

Date: **Signature of TA**

11. GAP ACCEPTANCE STUDY AT UNCONTROLLED INTERSECTION

Aim:

Equipment:

Theory:

Procedure:

Observations:

Name of Intersection:		**Date:**	
Name of Approach:		**Name of Observer:**	
Direction:		**Weather:** (Sunny/Rainy/Windy)	

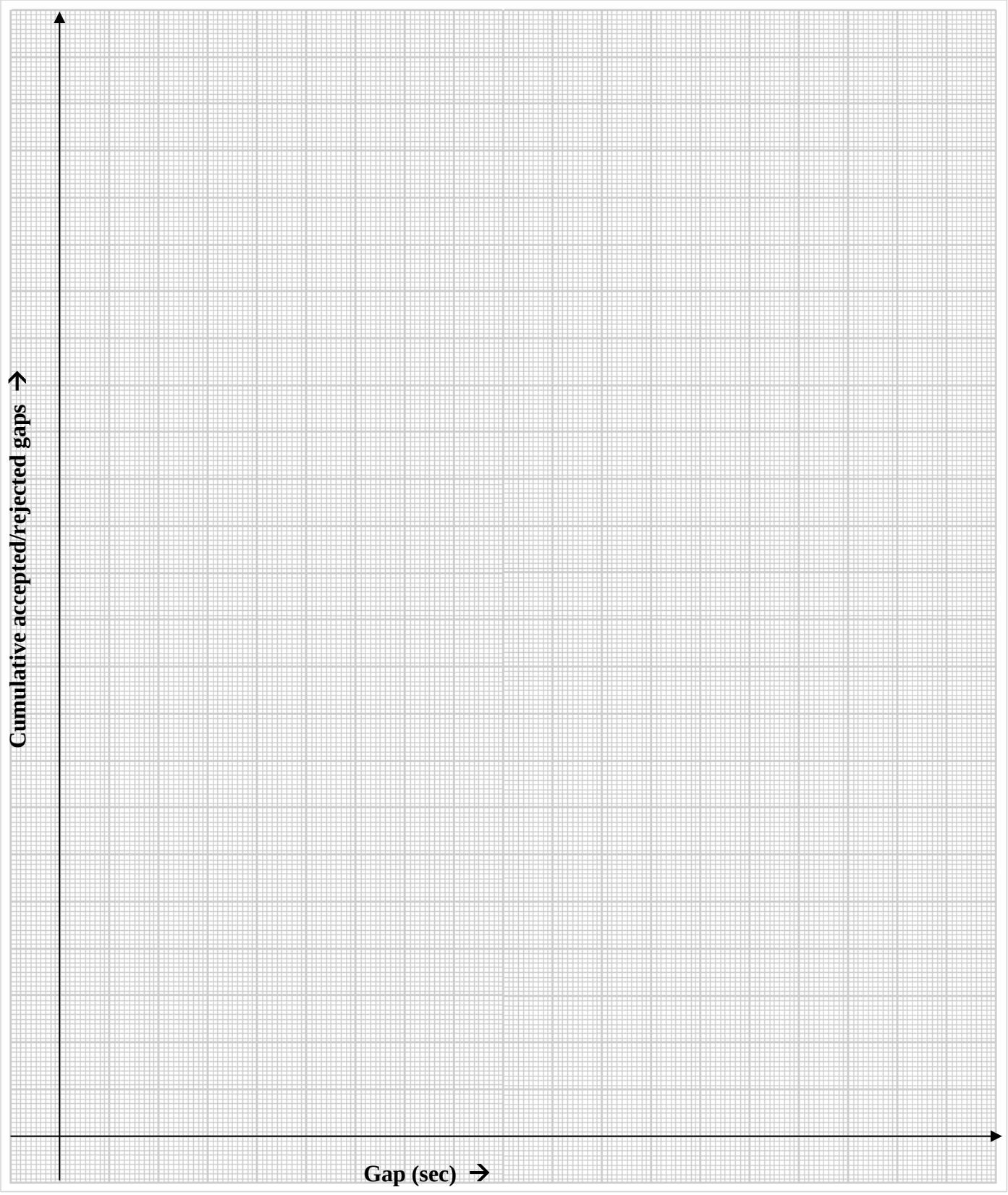
Title: Observed Accepted (A) and Rejected (R) gaps in seconds									
2W		**3W**		**Car**		**LCV**		**HCV**	
A	**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**	**R**

Calculations:

Vehicle Type: Two Wheeler

Range		Gap (sec)	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:

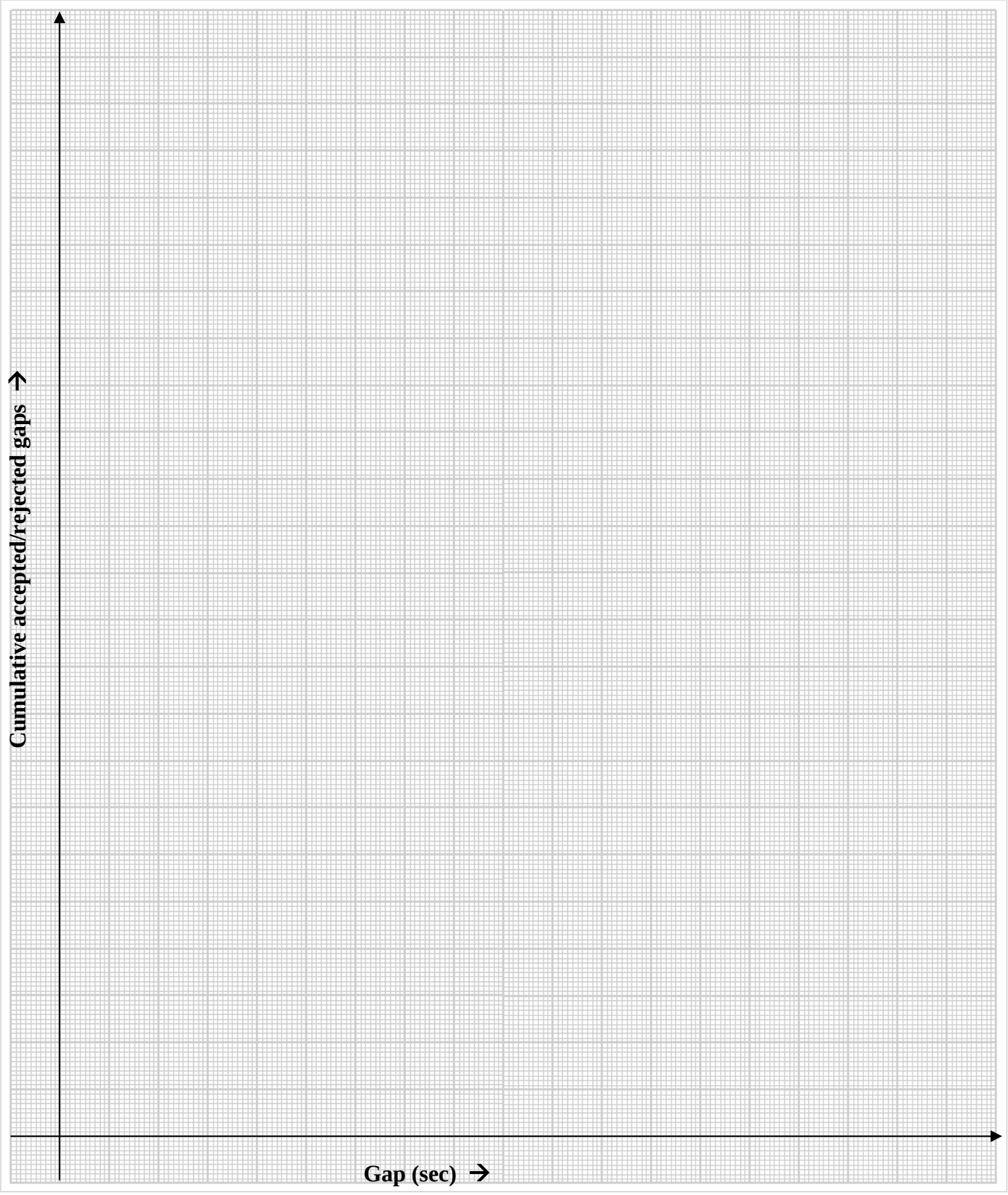


Graph Title: Critical gap for Two Wheeler

Vehicle Type: Three Wheeler

Range		Gap (sec)	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:

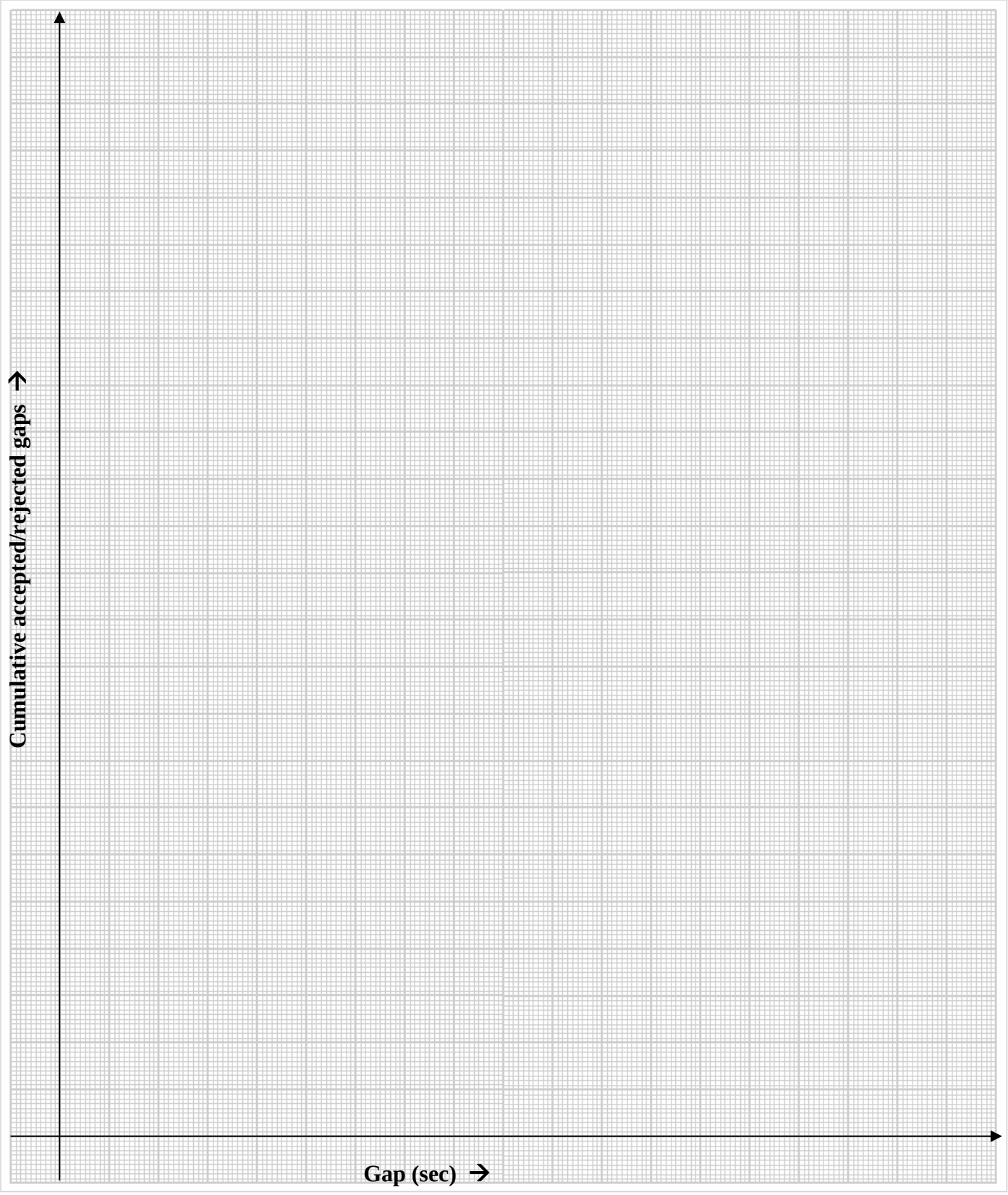


Graph Title: Critical gap for Three Wheeler

Vehicle Type: Car

Range		Gap (sec)	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:

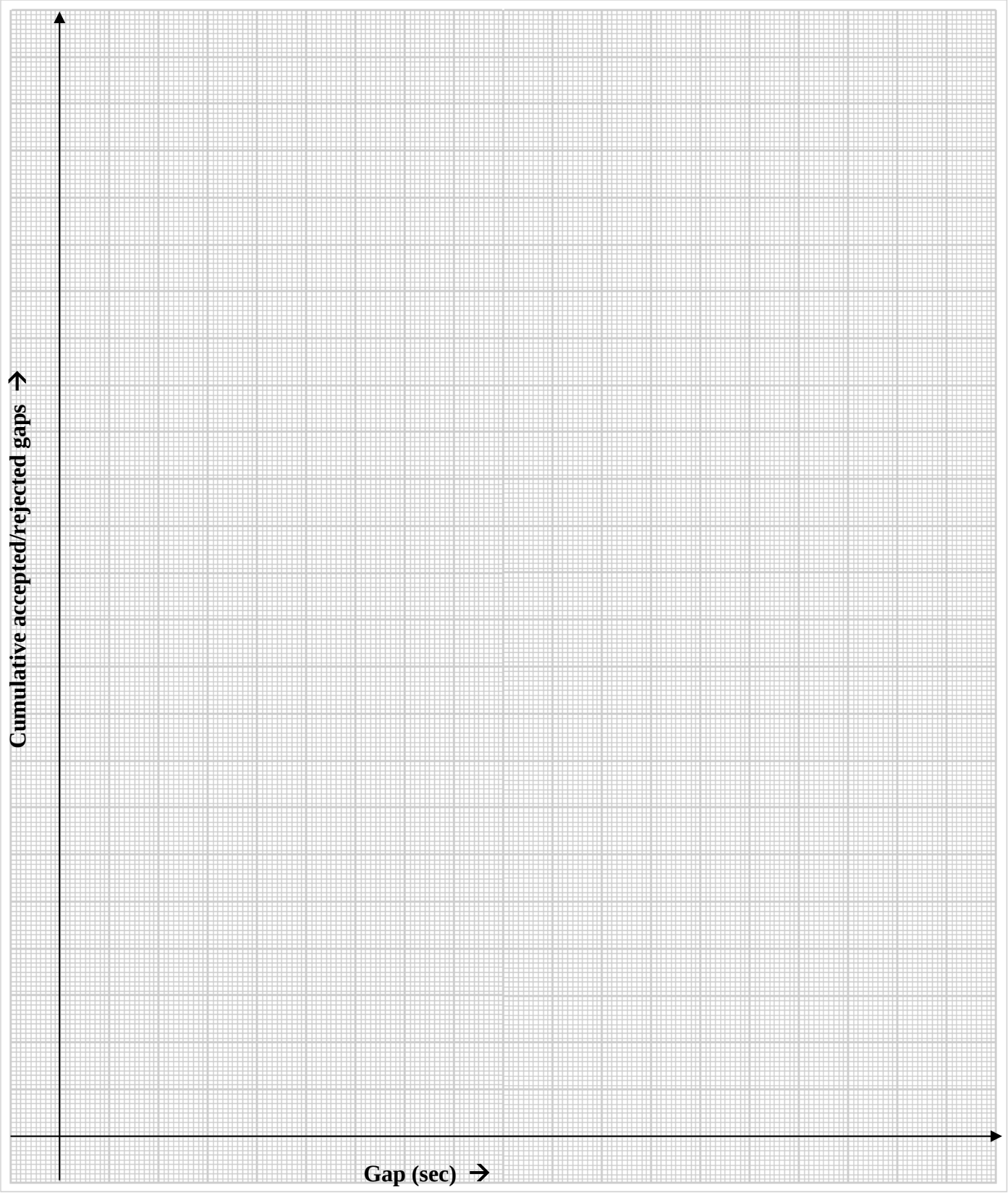


Graph Title: Critical gap for Car

Vehicle Type: LCV

Range		Gap (sec)	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:

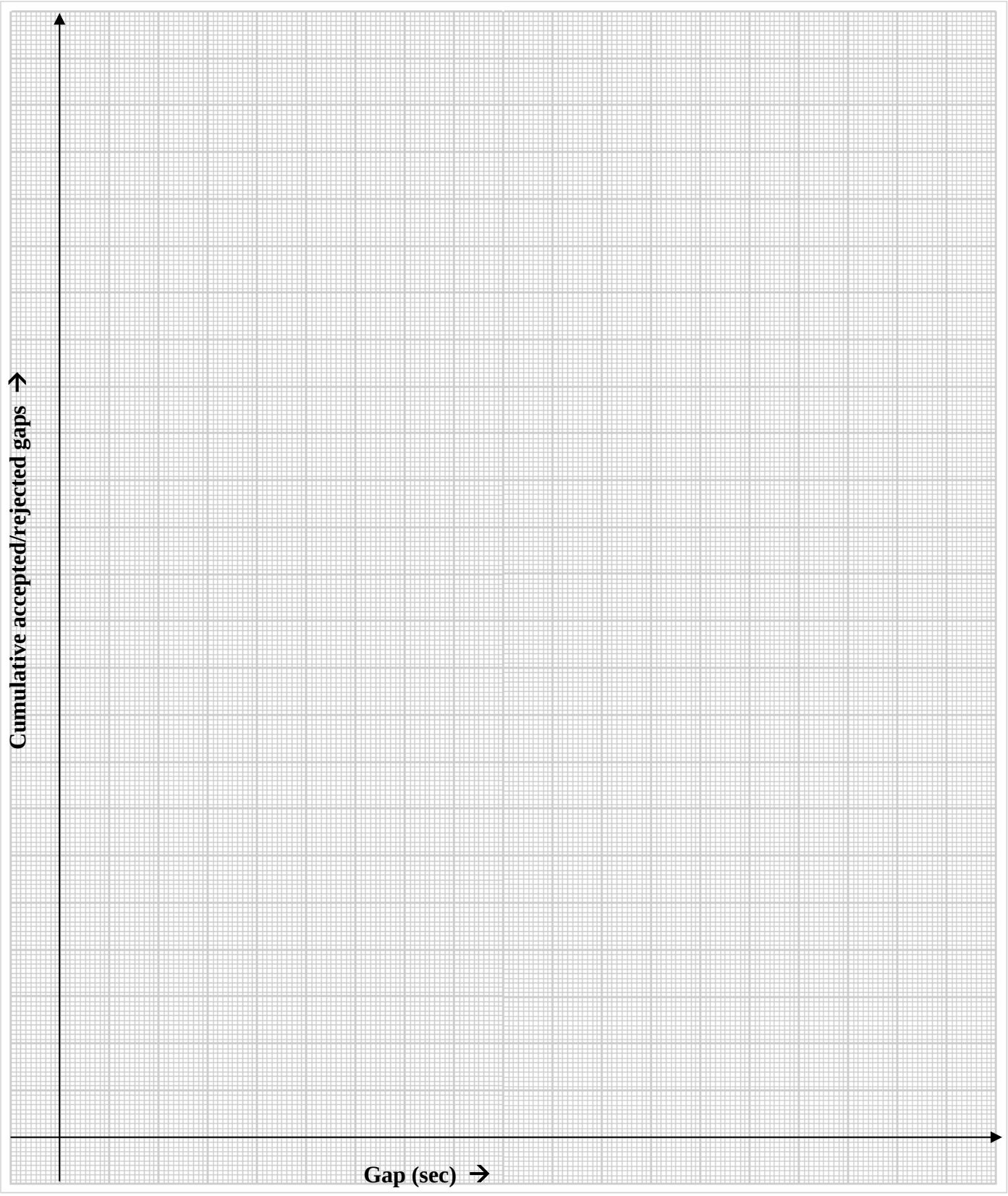


Graph Title: Critical gap for LCV

Vehicle Type: HCV

Range		Gap (sec)	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:

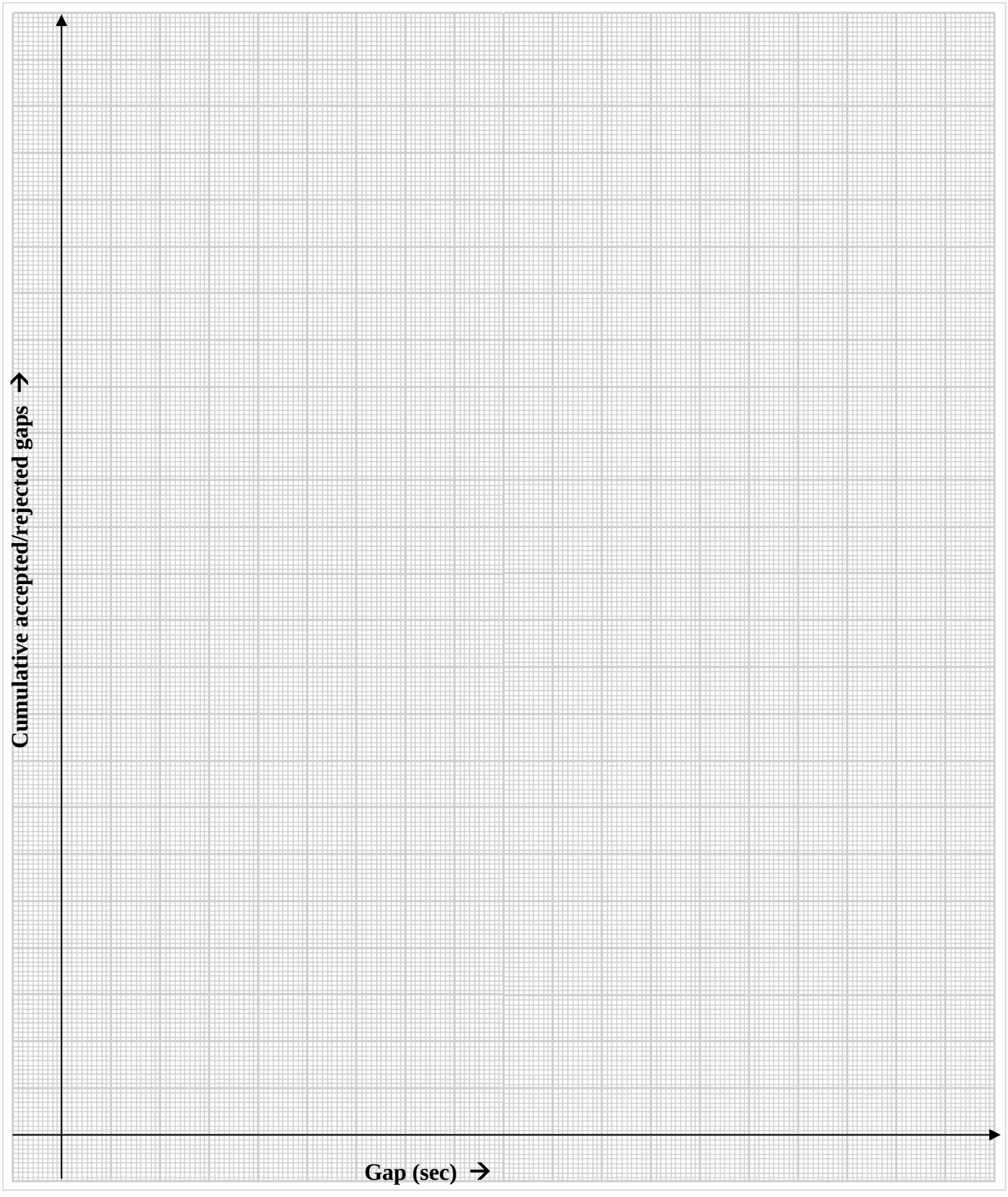


Graph Title: Critical gap for HCV

Vehicle Type: Total Vehicles

Range		Gap	Number of Gaps Accepted	Cumulative Gaps (<t)	Number of Gaps Rejected	Cumulative Gaps (>t)
From	To					

Critical Gap by Raff's Method:



Graph Title: Critical gap for Total Vehicles

Result:

Vehicle Type	Critical Gap (sec)	
	Raff's Method	From Graph
Two Wheeler		
Three Wheeler		
Car		
LCV		
HCV		
Total Vehicles		

Inference:

Date: **Signature of TA**

12. PEDESTRIAN BEHAVIOUR STUDY

Aim:

Equipment:

Theory:

Procedure:

Observations:

Name of Intersection:			**Date:**	
Name of Observer:			**Weather:** (Sunny/Rainy/Windy)	

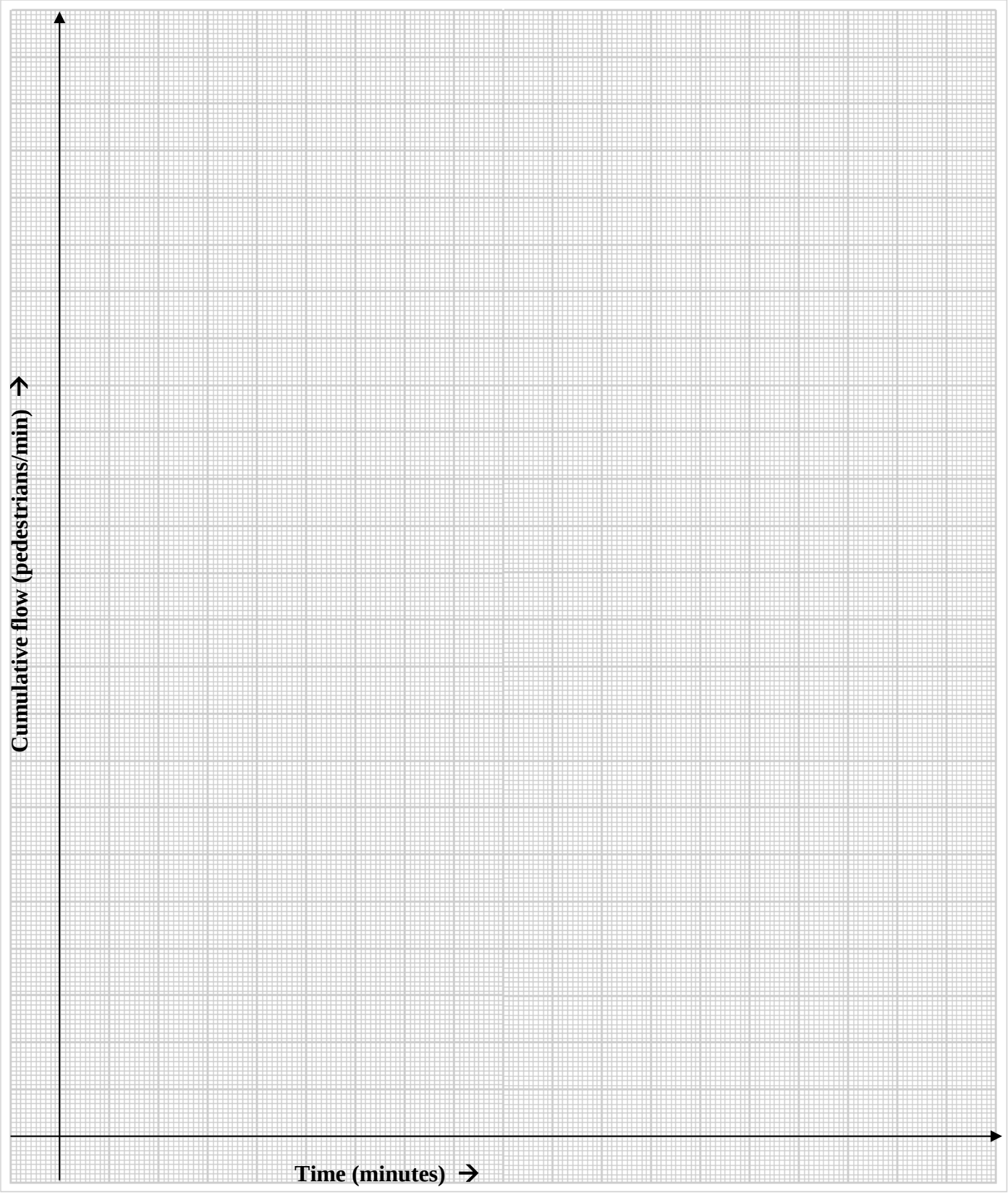
Title: Walking Time of Pedestrians (Distance_____)

Group	**Crossing time in seconds for _____direction**						**Average Time (sec)**	**Average Speed (m/s)**
	1	**2**	**3**	**4**	**5**	**6**		
1 person								
Group of 3								
Group of 5								
Above 5								

Group	**Crossing time in seconds for_____direction**						**Average Time (sec)**	**Average Speed (m/s)**
	1	**2**	**3**	**4**	**5**	**6**		
1 person								
Group of 3								
Group of 5								
Above 5								

Title: Pedestrian volume

Time (in minutes)	**Pedestrian Volume**		**Cumulative Volume**	
	Up	**Down**	**Up**	**Down**
10				
20				
30				
40				
50				
60				



Graph Title: Cumulative pedestrian flow vs time (for both directions)

Sample Calculation:

Result:

1. Cumulative pedestrian flow :
    a. Direction 1(_____):
    b. Direction 2(_____):
2. Average Speed of pedestrians:

Group Size	1	1-3	4-5	Above 5
a. Direction 1 b. Direction 2				

Inference:

Date: **Signature of TA**