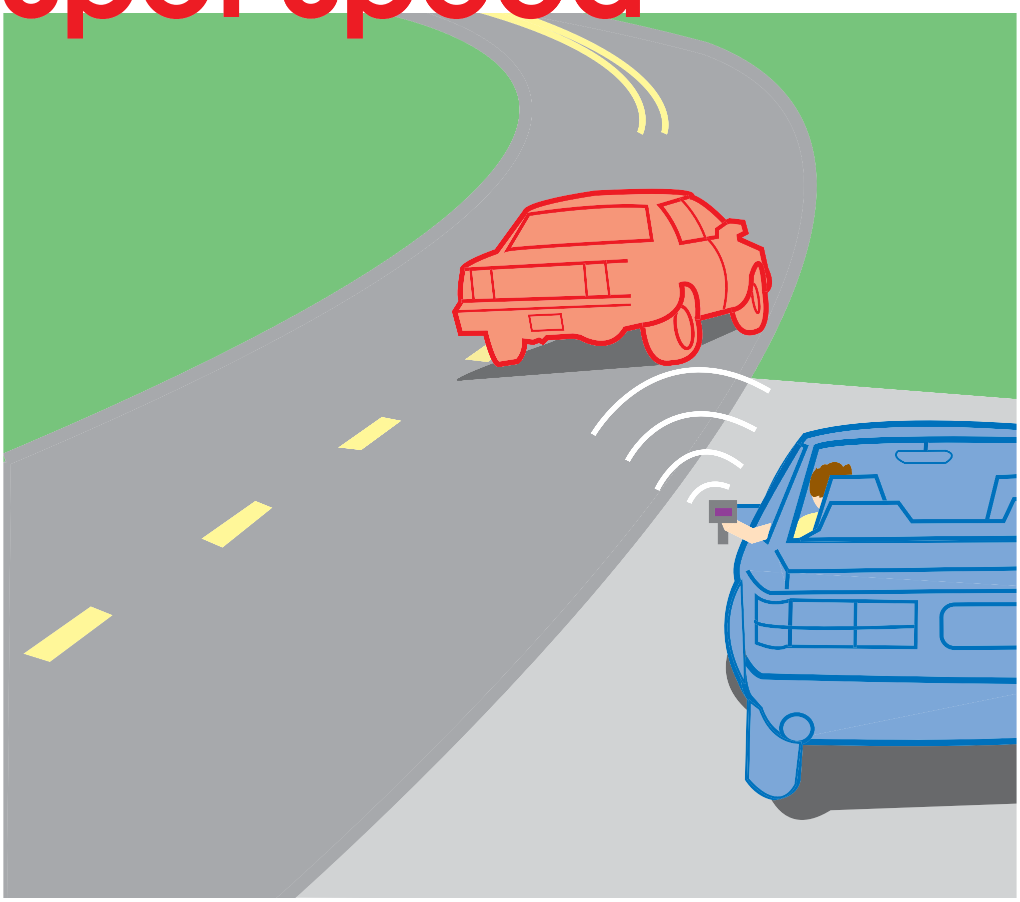
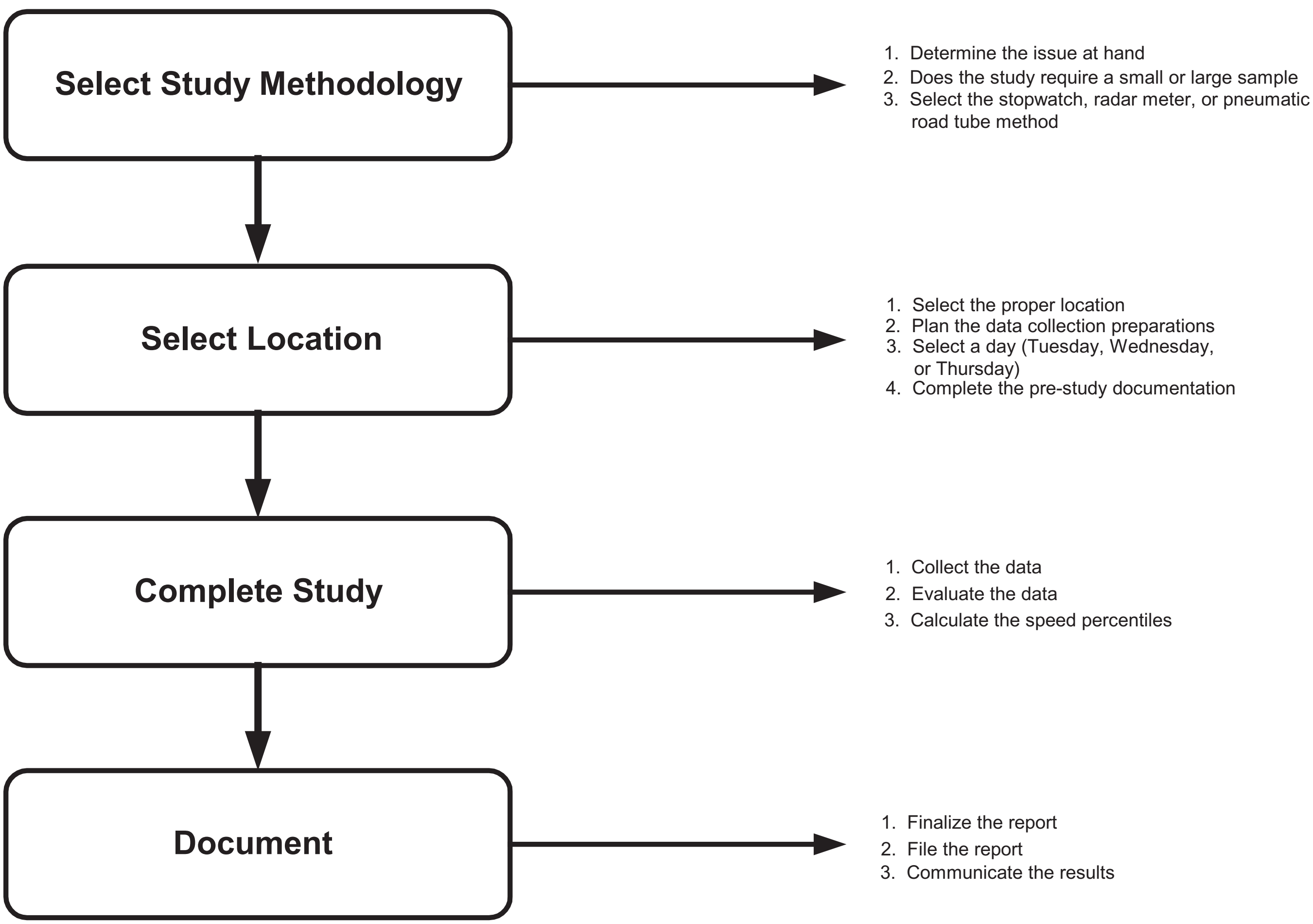
Spot Speed

2



Spot Speed


Select Study Methodology
1. Determine the issue at hand
2. Does the study require a small or large sample
3. Select the stopwatch, radar meter, or pneumatic road tube method
Select Location
1. Select the proper location
2. Plan the data collection preparations
3. Select a day (Tuesday, Wednesday, or Thursday)
4. Complete the pre-study documentation
Complete Study
1. Collect the data
2. Evaluate the data
3. Calculate the speed percentiles
Document
1. Finalize the report
2. File the report
3. Communicate the results

INTRODUCTION

Speed is an important transportation consideration because it relates to safety, time, comfort, convenience, and economics. Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed percentiles, which are useful in making many speed-related decisions. Spot speed data have a number of safety applications, including the following (Robertson 1994):

1. Determining existing traffic operations and evaluation of traffic control devices
   a. Evaluating and determining proper speed limits
   b. Determining the 50th and 85th speed percentiles (explained below)
   c. Evaluating and determining proper advisory speeds
   d. Establishing the limits of no-passing zones
   e. Determining the proper placements of traffic control signs and markings
   f. Setting appropriate traffic signal timing
2. Establishing roadway design elements
   a. Evaluating and determining proper intersection sight distance (for more information refer to Chapter 4 in this handbook)
   b. Evaluating and determining proper passing sight distance (for more information refer to Chapter 3 in the AASHTO *Green Book*)
   c. Evaluating and determining proper stopping sight distance (for more information refer to Chapter 4 in this handbook)
3. Assessing roadway safety questions
   a. Evaluating and verifying speeding problems
   b. Assessing speed as a contributor to vehicle crashes
   c. Investigating input from the public or other officials
4. Monitoring traffic speed trends by systematic ongoing speed studies
5. Measuring effectiveness of traffic control devices or traffic programs, including signs and markings, traffic operational changes, and speed enforcement programs

For a spot speed study at a selected location, a sample size of at least 50 and preferably 100 vehicles is usually obtained (Ewing 1999). Traffic counts during a Monday morning or a Friday peak period may show exceptionally high volumes and are not normally used in the analysis; therefore, counts are usually conducted on a Tuesday, Wednesday, and Thursday. Spot speed data are gathered using one of three methods: (1) stopwatch method, (2) radar meter method, or (3) pneumatic road tube method. These methods are described in this chapter in order from least expensive to most expensive. The stopwatch method is the least expensive and least accurate of the methods.

SPEED PERCENTILES AND HOW TO USE THEM

Speed percentiles are tools used to determine effective and adequate speed limits. The two speed percentiles most important to understand are the 50th and the 85th percentiles. The 50th percentile is the median speed of the observed data set. This percentile represents the speed at which half of the observed vehicles are below and half of the observed vehicles are above. The 50th percentile of speed represents the average speed of the traffic stream. The 85th percentile is the speed at which 85% of the observed vehicles are traveling at or below. This percentile is used in evaluating/recommending posted speed limits based on the assumption that 85% of the drivers are traveling at a speed they perceive to be safe (Homburger et al. 1996). In other words, the 85th percentile of speed is normally assumed to be the highest safe speed for a roadway section. Weather conditions may affect speed percentiles. For example, observed speeds may be slower in rainy or snowy conditions.

A frequency distribution table is a convenient way to determine speed percentiles. An example is given in Table 2.1. The frequency of vehicles is the number of vehicles recorded at each speed. The cumulative frequency is the total of each of the numbers (frequencies) added together row by row from lower to higher speed. The fourth column is a running percentage of the cumulative frequency.

Table 2.1. Example Frequency Distribution Table

Speed (mph)	Frequency of Vehicles	Cumulative Frequency	Cumulative Percent	Speed Percentile
15	1	1	1%	
18	2	3	3%	
21	6	9	9%	
24	12	21	21%	
27	13	23	23%	50th
30	20	54	54%	
33	18	72	72%	85th
36	14	86	86%	
39	6	92	92%	
42	6	98	98%	
45	1	99	99%	
48	1	100	100%	

The 50th and 85th speed percentiles are determined from the cumulative percent column. For the example data in Table 2.1, the 50th percentile falls between 27 and 30 mph and the 85th percentile falls between 33 and 36 mph. The calculation of speed percentiles is easier if a sample size of 100 vehicles is collected. When the sample size equals 100 vehicles, the cumulative frequency and cumulative percent are the same.

As can be observed from Table 2.1, the exact 50% and 85% (50th and 85th percentiles) are not found in the cumulative percent column. To reach these exact percentages, a calculation is completed using percentages and speeds from the distribution table. Shown below is the equation for calculating speed percentiles:

$$S_D = \frac{P_D - P_{\min}}{P_{\max} - P_{\min}}(S_{\max} - S_{\min}) + S_{\min}\,, \qquad (2.1)$$

where S_D = speed at P_D, P_D = percentile desired, $P_{\max}$ = higher cumulative percent, $P_{\min}$ = lower cumulative percent, $S_{\max}$ = higher speed, and $S_{\min}$ = lower speed.

Example speed percentile calculations follow, using the example frequency distribution table in Table 2.1. The 50th percentile of speed (P_D = 50%) falls between 27 and 30 mph (see Table 2.1), so $S_{\max}$ = 30 mph and $S_{\min}$ = 27 mph. The higher cumulative percent ($P_{\max}$) is 54%, and the lower cumulative percent ($P_{\min}$) is 23%. Therefore, to find S_D at P_D = 50%,

$$S_D = \frac{50\% - 23\%}{54\% - 23\%}(30\text{ mph} - 27\text{ mph}) + 27\text{ mph} = 29.6\text{ mph.}$$

The 85th percentile of speed (P_D = 85%) falls between 33 and 36 mph (see Table 2.1), so $S_{\max}$ = 36 mph and $S_{\min}$ = 33 mph. The higher cumulative percent ($P_{\max}$) is 86%, and the lower cumulative percent ($P_{\min}$) is 72%. To find S_D at P_D in this case (85th percentile of speed),

$$S_D = \frac{85\% - 72\%}{86\% - 72\%}(36\text{ mph} - 33\text{ mph}) + 33\text{ mph} = 35.8\text{ mph.}$$

(1) STOPWATCH METHOD

The stopwatch method can be used to successfully complete a spot speed study using a small sample size taken over a relatively short period of time. The stopwatch method is a quick and inexpensive method for collecting speed data.

Preparation Checklist for a Stopwatch Spot Speed Study

When preparing for a spot speed study using a stopwatch, use the checklist in Table 2.2. The checklist may be modified or expanded as necessary.

Table 2.2. Stopwatch Spot Speed Study Preparation Checklist

Step	Ö When Complete	Notes
Obtain stopwatch		
Obtain backup stopwatch		
Obtain 50–100 foot tape		
Obtain data collection forms		
Obtain hardhat and safety vest		
Obtain brightly colored reference posts		
Select time and day		
Contact local law enforcement		
Other:		

If an agency does not possess the equipment necessary to complete a spot speed study using a stopwatch, it may be obtained from the Iowa DOT, another jurisdiction, or a responsible consulting firm.

Key Steps to a Stopwatch Spot Speed Study

A stopwatch spot speed study includes five key steps:

1. Obtain appropriate study length.
2. Select proper location and layout.
3. Record observations on stopwatch spot speed study data form.
4. Calculate vehicle speeds.
5. Generate frequency distribution table and determine speed percentiles.

Obtain Appropriate Study Length

The study length is important because it is used in the calculation of vehicle speeds. Table 2.3 provides recommended study lengths, which are based on the average speed of the traffic stream. Using these recommended study lengths makes speed calculations straightforward and less confusing. If these lengths are not appropriate, another length can be used assuming it is long enough for reliable observer reaction times.

Table 2.3. Recommended Spot Speed Study Lengths

Traffic Stream Average Speed	Recommended Study Length (feet)
Below 25 mph	88
25–40 mph	176
Above 40 mph	264

Select Proper Location and Layout

Figure 2.1 illustrates a typical layout for conducting a spot speed study using a stopwatch. When selecting a location and layout, care must be exercised so that the observer can clearly see any vertical reference posts. The observer should be positioned higher than the study area and be looking down. The position could be on a bridge or a roadway back slope. The observer should use reference points to aid in collecting the elapsed time it takes a vehicle to travel through the study area. The reference point to start timing may be a brightly colored vertical post. The reference point to end timing may be a tree or a signpost in the observer's sight line. An accurate sketch of the site should be documented, including number of lanes, position of observer, and description of reference points (see Figure 2.1 for an example).

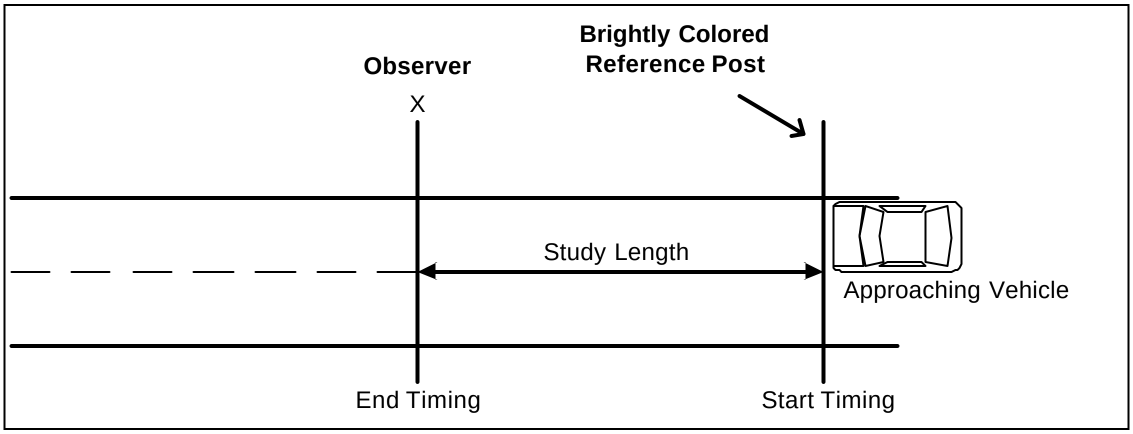


Figure 2.1. Stopwatch Spot Speed Study Layout

Record Observations on Stopwatch Spot Speed Data Form

On the stopwatch spot speed data form (a blank form is provided in Appendix A.1), the observer records the date, location, posted speed limit, weather conditions, start time, end time, and down time. As the front wheels of a vehicle (or only the lead vehicle in a group) cross a mark or pavement crack at the beginning of the predetermined study length, the observer starts the stopwatch. The watch is stopped when the vehicle's front wheels pass a reference line in front of the observer. A slash is recorded on the data form corresponding to the elapsed time observed.

Calculate Vehicle Speeds

To calculate vehicle speed, use the predetermined study length and the elapsed time it took the vehicle to move through the course (as recorded on the stopwatch data form) in the following formula (Robertson 1994):

$$V = \frac{D}{1.47T}, \qquad (2.2)$$

where V = spot speed (mph), D = length (feet), and T = elapsed time (seconds). In the equation, 1.47 is a constant that converts units of feet per second into miles per hour. For example, if the spot speed study length is 100 feet and the motorist's elapsed time is 2.5 seconds, the motorist is traveling at

$$\frac{100 \text{ feet}}{1.47(2.5 \text{ seconds})} = 27 \text{ mph.}$$

Generate Frequency Distribution Table and Determine Speed Percentiles

Determine the 50th and 85th speed percentiles using a frequency distribution table and calculations as described earlier.

Example Stopwatch Spot Speed Study

The city of Cottonwood Glen received a complaint of afternoon traffic speeding in a residential area. The city suspected this was related to students leaving a nearby high school. The first action taken by the city was to quantify the facts by conducting a spot speed study. The city decided to use the stopwatch method because of their limited resources.

A location was selected near the intersection of 4th Street and University Avenue, approximately two blocks from the high school and where the city had received multiple speeding complaints from residents. The posted speed limit is 30 mph. The study was conducted on a Wednesday and started at 3:00 p.m. The time was selected to correspond to the period when most high school students leave the school. The study continued until a sample size of 100 vehicles was measured. The study length of 176 feet was used because the posted speed limit is between 25 and 40 mph, as shown in Table 2.3. The study layout is illustrated in Figure 2.2.

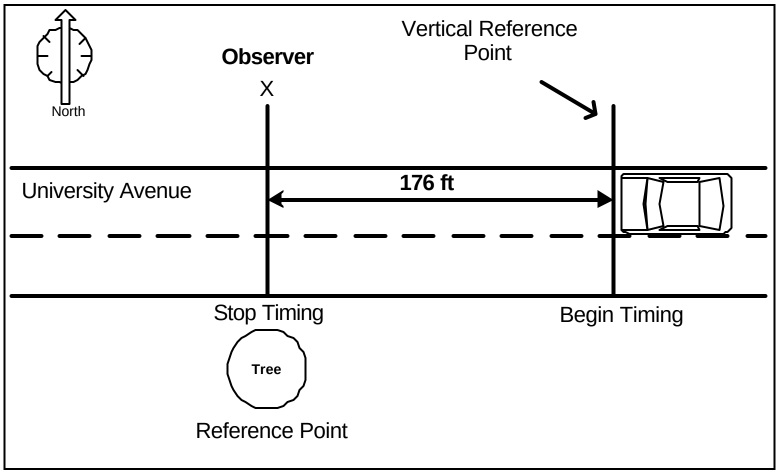


Figure 2.2. Example Stopwatch Spot Speed Study Layout

The vertical reference point is the "begin timing" reference. A tree is the "stop timing" reference point. This vertical reference point helps with the accuracy of timing by providing a line-of-sight to aid the observer. The results of the study are shown in Figure 2.3 (data form) and Table 2.4 (distribution table). Figure 2.3 shows elapsed time in predetermined 0.2-second intervals (Robertson 1994).

The study shows that the 50th percentile or median speed falls between 27.2 and 28.9 mph, and the 85th percentile of speed falls between 33.3 and 35.2 mph. Equation 2.1 is used to find the exact speeds for the 50th and 85th percentiles of speed. For the 50th percentile of speed, P_D = 50%, $P_{\max}$ = 54%, $P_{\min}$ = 41%, $S_{\max}$ = 28.9 mph, and $S_{\min}$ = 27.2 mph, so

$$S_D = \frac{50\% - 41\%}{54\% - 41\%}(28.9\text{ mph} - 27.2\text{ mph}) + 27.2\text{ mph} = 28.4\text{ mph.}$$

For the 85th percentile of speed, P_D = 85%, $P_{\max}$ = 92%, $P_{\min}$ = 83%, $S_{\max}$ = 35.2 mph, and $S_{\min}$ = 33.3 mph, so

$$S_D = \frac{85\% - 83\%}{92\% - 83\%}(35.2\text{ mph} - 33.3\text{ mph}) + 33\text{ mph} = 33.4\text{ mph.}$$

Date: MM/DD/YY Name: John Doe Location: 4th Street and University Avenue Speed Limit: 30 mph				Start Time: 1500 End Time: 1545 Down Time: N.A. Weather: Clear				
Seconds	**mph for 176 feet**	**Passenger Vehicles**		**Buses**		**Trucks**		**Total**
		Record	**No.**	**Record**	**No.**	**Record**	**No.**	
1.0	120.0							
1.2	100.0							
1.4	85.7							
1.6	75.5							
1.8	66.6							
2.0	60.0							
2.2	54.5							
2.4	50.0							
2.6	46.1							
2.8	42.8	I	1					1
3.0	40.0	I	1					1
3.2	37.5	~~IIII~~ I	6					6
3.4	35.2	~~IIII~~ IIII	9					9
3.6	33.3	~~IIII~~ III	8			II	2	10
3.8	31.5	~~IIII~~ III	8			II	2	10
4.0	30.0	~~IIII~~ I	6			III	3	9
4.2	28.9	~~IIII~~ ~~IIII~~	10	III	3			13
4.4	27.2	~~IIII~~ IIII	9			II	2	11
4.6	26.1	~~IIII~~ II	7			II	2	9
4.8	25.0	~~IIII~~ II	7			I	1	8
5.0	24.0	IIII	4	I	1	II	2	7
5.2	23.0	I	1					1
5.4	22.2	II	2			1	1	2
5.6	21.4	III	3					3
5.8	20.6							
6.0	20.0							
6.2	19.3							
6.4	18.7							
6.6	18.1							
6.8	17.6							
7.0	17.1							
Total								100

Figure 2.3. Example Stopwatch Spot Speed Study Data Form

Table 2.4. Example Stopwatch Spot Speed Study Distribution Table

Speed (mph)	Frequency of Vehicles	Cumulative Frequency	Cumulative Percent	Speed Percentile
21.4	3	3	3%	
22.2	2	5	5%	
23	1	6	6%	
24	7	13	13%	
25	8	21	21%	
26.1	9	30	30%	
27.2	11	41	41%	50th
28.9	13	54	54%	
30	9	63	63%	
31.5	10	73	73%	
33.3	10	83	83%	85th
35.2	9	92	92%	
37.5	6	98	98%	
40	1	99	99%	
42.8	1	100	100%	

A 5-mph rule of thumb is sometimes used to determine whether the 85th percentile of speed is too high compared to the posted speed limit. If the 85th percentile of speed is 5 mph or more above the posted speed limit, the situation should be evaluated. In this case, the 85th percentile of speed was 3.4 mph above the posted speed limit, so speeding may not have been an issue. If the 85th percentile of speed would have been 5 mph or more above the posted speed limit, the following actions could have been considered:

- Adjust the posted speed limit.
- Increase speeding enforcement.
- Initiate traffic calming measures.
- Conduct public awareness efforts.

(2) RADAR METER METHOD

A radar meter is a commonly used device for directly measuring speeds in spot speed studies (see Figure 2.4). This device may be hand-held, mounted in a vehicle, or mounted on a tripod. The effective measuring distance for radar meters ranges from 200 feet up to 2 miles (Parma 2001). A radar meter requires line-of-sight to accurately measure speed and is easily operated by one person. If traffic is heavy or the sampling strategy is complex, two radar units may be needed.

Figure 2.4. Radar Meter

Different sized vehicles and the detection of the observation vehicle may affect radar readings (Currin 2001). Large vehicles such as trucks and buses send the strongest return signal to the radar meters and as a result smaller vehicles may not be detected. If there is a presence of large vehicles, the observer may need to record the speeds of vehicles that are alone. Also, some vehicles are equipped with radar detectors to warn them that a radar unit is operating in their vicinity. Drivers will slow down when warned by a detector. It is not unusual for other drivers to slow down also. This slowing will affect the study results. The radar unit may be turned off while not in use so radar detectors cannot detect it.

Radar Meter Spot Speed Study Preparation Checklist

When preparing for a spot speed study using a radar meter, use the checklist in Table 2.5. The checklist may be modified or expanded as necessary.

Table 2.5. Radar Meter Spot Speed Study Preparation Checklist

Step	Ö When Complete	Notes
Obtain radar meter		
Read instructions and safety directions for the radar meter		
Obtain backup battery		
Obtain tripod to support radar meter		
Create data collection forms		
Obtain hardhat and safety vest		
Select time and day		
Contact local law enforcement		
Other:		

Because of its cost, a radar meter may be the most difficult piece of equipment for an agency to obtain. A radar meter can be purchased, or one may be obtained (rented or borrowed) from a local law enforcement agency.

Key Steps to a Radar Meter Spot Speed Study

A radar meter spot speed study includes four key steps:

1. Select proper location and placement of radar meter.
2. Determine an appropriate selection strategy.
3. Record observations on radar meter spot speed study data form.
4. Generate frequency distribution table and determine speed percentiles.

Select Proper Location and Placement of Radar Meter

Proper placement of the radar meter at the study area is critical. The positioning of the radar unit is determined by the capabilities of the radar unit (as listed in the users' manual). The unit should also be concealed from the view of motorists. Effective ranges may be up to 2 miles, but as the distance increases the effectiveness decreases (Robertson 1994). The least accurate position, which often results in no readings at all, is obtained when the meter is aimed at a 90-degree angle to the roadway centerline (Homburger et al. 1996). An accurate sketch of the site should be documented, including number of lanes, position of observer, and description of reference points.

Determine an Appropriate Selection Strategy

Except for studies conducted under low-volume conditions, it is impossible to obtain a radar measurement for every vehicle. For peak flow analysis, speeds are measured during the peak period. For assessing general speed trends or for setting speed limits, off-peak measurements are more appropriate.

The selection of the target vehicle that represents the vehicle population under study is also important. A good question to ask is, “What type or types of vehicles are of concern—cars, trucks, buses, or others?” Typically cars, station wagons, pickup and panel trucks, and motorcycles are classified as passenger cars. Other trucks and buses are classified as trucks. School buses and farm equipment may be recorded separately. When the target vehicle is defined, a selection strategy is developed to provide a random sample. A random sample will reduce the tendency to select the vehicles that stand out. For example, the observer could obtain a speed reading from every fourth vehicle or every tenth vehicle.

Record Observations on Radar Meter Spot Speed Data Form

On the radar meter spot speed data form (a blank form is provided in Appendix A.2), the observer records the date, location, posted speed limit, weather conditions, start time, end time, and down time. A slash is recorded on the data form corresponding to speed observed for each selected vehicle (or only the lead vehicle in a group) under the appropriate vehicle-type classification.

Generate Frequency Distribution Table and Determine Speed Percentiles

Determine the 50th and 85th speed percentiles using a frequency distribution table and calculations as described earlier.

Example Radar Meter Spot Speed Study

The city of McIntyre noticed a high number of traffic crashes in the morning along Main Street. The city decided to conduct a spot speed study to see how vehicle speeds compared to the posted speed limit. The police department offered their radar meter to be used and so the city decided to use the radar meter method to conduct the spot speed study. The city determined they would not need assistance from local law enforcement personnel. The study was conducted from within a vehicle, so a hardhat and safety vest were not required.

The city decided to conduct the study near the corner of 6th Street and Main Street, the intersection where a larger number of the crashes were occurring. The posted speed limit on Main Street is 35 mph. The study was conducted on a Thursday, from 7:00 a.m. to 7:25 a.m. The time period was chosen to capture morning commutes to the local high school and to work. A sample size of 100 was recorded. The study layout is illustrated in Figure 2.5. The observer used a tree to conceal the observation vehicle from the target vehicles. The results of the study are shown in Figure 2.6 (data form) and Table 2.6 (distribution table).

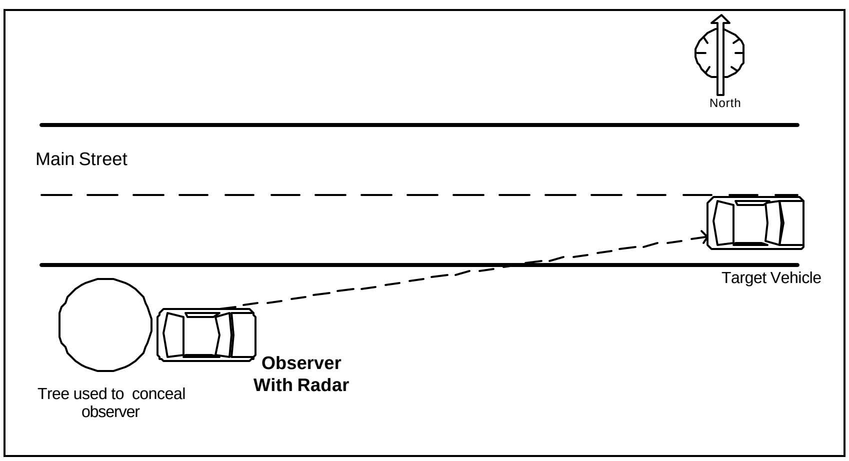


Figure 2.5. Example Radar Meter Spot Speed Study Layout

Date: MM/DD/YY — Start Time: 0700
Name: John Doe — End Time: 0725
Location: 6th Street and Main Street — Down Time: N.A.
Speed Limit: 35 mph — Weather: Clear

Speed	Passenger Vehicles		Buses		Trucks		Total
	Record	No.	Record	No.	Record	No.	
15							
16							
17							
18							
19							
20							
21	I I	2					2
22					I	1	1
23	I	1			I I	2	3
24	I I I I	4					4
25	I	1					1
26	I I I	3					3
27	I I	2			I	1	3
28	I I	2					2
29	~~I I I I~~	5	I I	2			7
30	I I	2			I	1	3
31	I I I	3					3
32	~~I I I I~~	5					5
33	I I I	3					3
34	I I I	3	I	1	I	1	5
35	~~I I I I~~ I	6			I I	2	8
36	~~I I I I~~ I	6					6
37	~~I I I I~~ I	6			I I	2	8
38	I I I I	4					4
39	~~I I I I~~ I	6					6
40	I I I I	4					4
41	~~I I I I~~	5			I I	2	7
42	I I I	3					3
43	I I	2					2
44	I I I I	4					4
45	I I	2					2
46							
47	I	1					1
48							
49							
50							
Total							100

Figure 2.6. Example Radar Meter Spot Speed Study Data Form

Table 2.6. Example Radar Meter Spot Speed Distribution Table

Speed (mph)	Frequency of Vehicles	Cumulative Frequency	Cumulative Percent	Speed Percentile
21	2	2	2%	
22	1	3	3%	
23	3	6	6%	
24	4	10	10%	
25	1	11	11%	
26	3	14	14%	
27	3	17	17%	
28	2	19	19%	
29	7	26	26%	
30	3	29	29%	
31	3	32	32%	
32	5	37	37%	
33	3	40	40%	
34	5	45	45%	50th
35	8	53	53%	
36	6	59	59%	
37	8	67	67%	
38	4	71	71%	
39	6	77	77%	
40	4	81	81%	85th
41	7	88	88%	
42	3	91	91%	
43	2	93	93%	
44	4	97	97%	
45	2	99	99%	
47	1	100	100%	

The study shows the 50th percentile or median speed was between 34 and 35 mph, and the 85th percentile of speed was between 40 and 41 mph. Equation 2.1 is used to find the exact speeds for the 50th percentile of speed and the 85th percentile of speed. For the 50th percentile of speed, P_D = 50%, $P_{\max}$ = 53%, $P_{\min}$ = 45%, $S_{\max}$ = 35 mph, and $S_{\min}$ = 34 mph, so

$$S_D = \frac{50\% - 45\%}{53\% - 45\%}(35\,\text{mph} - 34\,\text{mph}) + 34\,\text{mph} \;= 34.6\text{ mph.}$$

For the 85th percentile of speed, P_D = 85%, $P_{\max}$ = 88%, $P_{\min}$ = 81%, $S_{\max}$ = 41 mph, and $S_{\min}$ = 40 mph, so

$$S_D = \frac{85\% - 81\%}{88\% - 81\%}(41\,\text{mph} - 40\,\text{mph}) + 40\,\text{mph} = 40.6\text{ mph.}$$

A 5-mph rule of thumb is sometimes used to determine whether the 85 percentile of speed is too high compared to the posted speed limit. If the 85th percentile of speed is 5 mph or more above the posted speed limit, the situation should be evaluated. In this case, the 85th percentile of speed was 5.6 mph above the posted speed limit, so speeding may be an issue. This situation should be considered for further evaluation. The following actions may be considered:

- Adjust the posted speed limit.
- Increase speeding enforcement.
- Initiate traffic calming measures.
- Conduct public awareness efforts.

Information on contracting for a spot speed study, including a project work order using the city of McIntyre example, is provided near the end of this chapter.

(3) PNEUMATIC ROAD TUBE METHOD

The pneumatic road tube method is normally used for longer data collection time periods than those of either the stopwatch or radar meter method. Using this method, pneumatic tubes are placed in the travel lanes (see Figure 2.7) and are connected to recorders located at the side of the road (see Figure 2.8).

Figure 2.7. Pneumatic Road Tubes

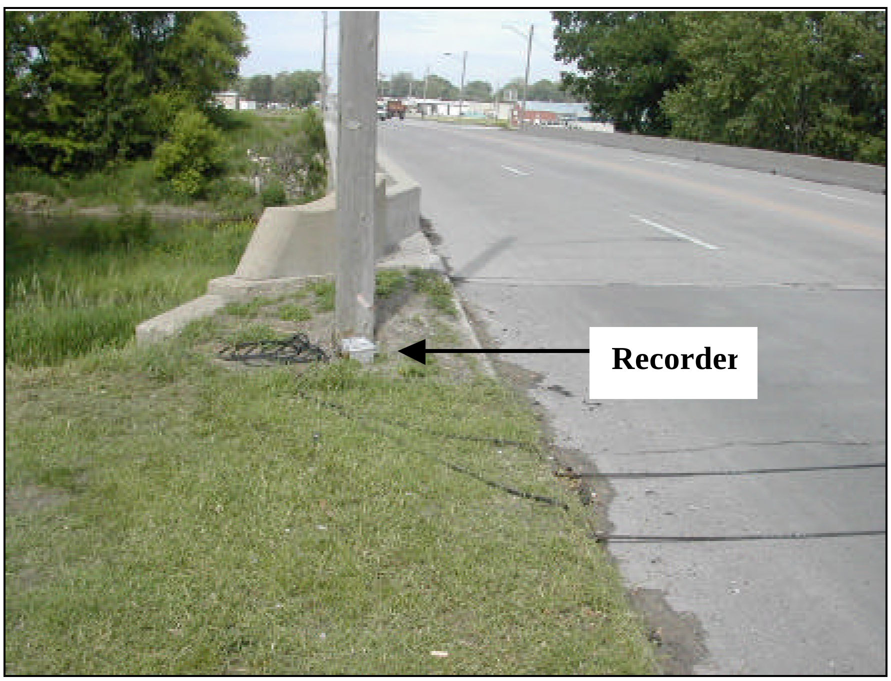


Figure 2.8. Road Tubes and Recorder

The automatic recorders are capable of storing large amounts of individual vehicle data or even larger amounts of vehicle classification data. The collected data are downloaded from the recorder to a laptop computer or portable floppy disk drive in the field, or via telephone modem to a centrally located computer.

Pneumatic Road Tube Spot Speed Study Preparation Checklist

When preparing for a spot speed study using pneumatic road tubes, use the checklist in Table 2.7. The checklist may be modified or expanded as necessary.

Table 2.7. Pneumatic Road Tube Spot Speed Study Preparation Checklist

Step	Ō When Complete	Notes
Obtain equipment		
Read users' manual		
Obtain measuring tape for spacing tubes		
Obtain software		
Obtain scissors for trimming tubes		
Select method for attaching tubes to the roadways		
Obtain recorders		
Obtain new batteries for recorders		
Obtain hardhat and safety vest		
Select time and day		
Select location		
Involve corresponding jurisdiction to provide traffic control		
Other:		

Pneumatic road tube spot speed studies require specialized equipment and knowledge of how to maintain the equipment. Few jurisdictions have the equipment to adequately complete this study; most jurisdictions require assistance from the Iowa DOT or a consulting firm. Information on contracting for a spot speed study, including a project work order example, is provided near the end of this chapter.

Key Steps to a Pneumatic Road Tube Spot Speed Study

A pneumatic road tube spot speed study includes four key steps (Robertson 1994):

1. Perform necessary office preparations.
2. Deploy and calibrate data collection equipment.
3. Check data and retrieve equipment.
4. Generate frequency distribution table and determine speed percentiles.

Perform Necessary Office Preparations

During office preparations, coordinate all data collection activities with appropriate state and local officials, including transportation, traffic, and law enforcement agencies. For example, you may coordinate with state or local officials in obtaining traffic control for the deployment and recovery of equipment. The field team must be briefed on the data collection process to ensure that all observers are collecting the same type of data. The team should assemble and inspect all tools, supplies, and equipment. Each piece of equipment should be tested in advance of using.

Deploy and Calibrate Data Collection Equipment

The road tubes are prepared on the roadside to minimize the time each traffic lane is closed. Workers then place the road tubes across the lanes. The location of the tubes should be outside the influence of other factors such as an intersection, major access points, etc. The separation of the pneumatic tubes should be 2–15 feet. For the specific spacing of the pneumatic tubes refer to the users' manual. Traffic control should be provided to protect the crew. After placing, the crew should make sure that the tubes are functioning properly. Finally, the crew can secure the road tubes to the pavement. To avoid theft, the recorder should be secured.

Check Data and Retrieve Equipment

The accuracy of the equipment in measuring the speeds of the traffic stream should be checked. The recorder first measures the elapsed time it takes the vehicle to pass over the tubes. Then this time interval is converted to the corresponding spot speed. The elapsed time can be checked with a stopwatch. The crew can adjust the recorder until the correct speeds are being recorded. It is advisable to check the function and accuracy of the equipment at least once during every 24-hour data collection period. When the data collection period has ended, the recorded data should be checked again for accuracy. Crews recover data collection equipment by reversing the process they used to deploy it.

Generate Frequency Distribution Table and Determine Speed Percentiles

Determine the 50th and 85th speed percentiles using a frequency distribution table and calculations as described earlier.

CONTRACTING FOR A SPOT SPEED STUDY

Information Gathering

Before a jurisdiction contacts an engineering consulting firm to perform a spot speed study, a variety of information may need to be collected. Any available information may aid the consulting firm in adequately completing the study. The following is a list of possible information that an engineering consulting firm may request:

- written description of the issue at hand
- map of posted speed limits in the area
- preliminary speed studies
- proposed future land use changes
- documented citizen input
- location map
- appropriate contact persons
- any other relevant information

The following project work order may assist local governments in contracting to an engineering firm. The example project work contains information from the radar method example (a blank form is provided in Appendix E).

Project Work Order: Spot Speed Study

Referenced Agreement

This work order is part of an agreement between KWB Consulting and the city of McIntyre for municipal engineering services.

Project Location Description

This work involves conducting a spot speed study near the location of 6th Street and Main Street in McIntyre. A map depicting the location is attached.

Obligation of the City/County

The city shall provide the following items to the consultant: map of post speed limits, preliminary spot speed studies, and list of important contacts.

Scope of Consultant Services

This work includes gathering and evaluating spot speed data. The 85th percentile of speed will be calculated along with recommendations for improvement of the study area if needed.

Schedule

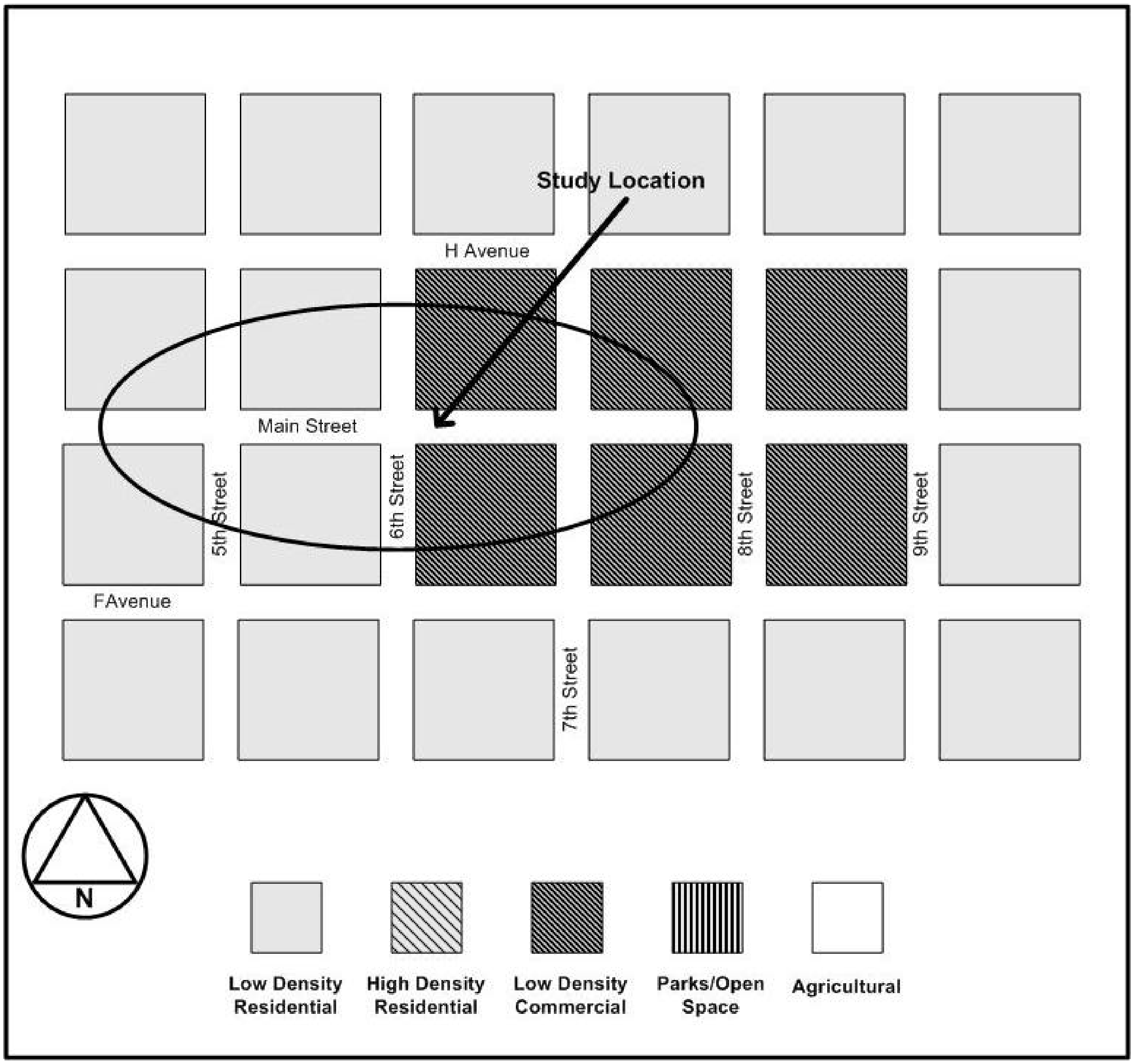
Field meeting date:	____________________
Estimated date of preliminary deliverable:	____________________
Estimated date of final deliverable:	____________________

Compensation

Labor cost	$
Direct expenses	$
Subcontractor cost	$____________________
Overhead	$____________________
Maximum payable	$

Authorization

City of McIntyre	KWB Consulting
City/County	Contractor
____________________	____________________
City/County Administrator	Project Manager's Name/Title
____________________	____________________
Signature	Signature
____________________	____________________
Date	Date


Study Location
H Avenue
Main Street
FAvenue
5th Street
6th Street
7th Street
8th Street
9th Street
N
Low Density Residential
High Density Residential
Low Density Commercial
Parks/Open Space
Agricultural

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