

Problem set 8-5

1. The passage in italics below is taken verbatim from:
The City of Saratoga, CA, 85th Percentile Speed,
<http://www.saratoga.ca.us/civicax/filebank/blobdload.aspx?blobid=3010>
4/5/2009

Updated: 2020

<https://www.saratoga.ca.us/DocumentCenter/View/2518/2020-Speed-Survey-PDF>

85th Percentile Speed

On most local streets, the speed limit is posted as 25 miles per hour (mph). In all residential and business districts where a limit is not posted, 25 mph this is the implied limit. Speed limits on higher capacity streets including major collector and arterial streets are set based on engineering and traffic surveys that include a review of speed data, design parameters, and operational issues.

Traffic engineers rely on the 85th percentile rule to help establish speed limits on nonlocal streets. Typically, the speed limit is set to the speed that separates the bottom 85% of vehicle speeds from the top 15%. For example, if speeds of 100 vehicles are measured and 85 vehicles are traveling at 37 mph or less, the speed limit for the subject street could be set at 35 mph. Statistically, the 85th percentile speed is slightly greater than the speed that is one standard deviation above the mean of a normal distribution.

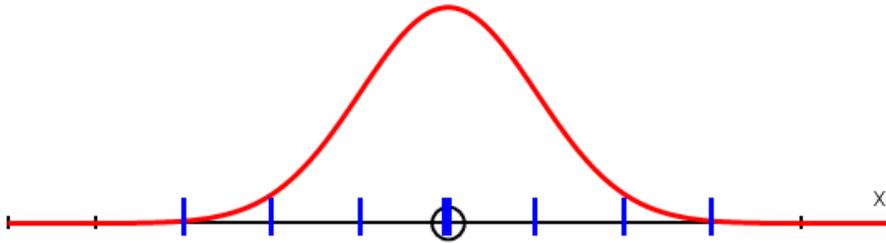
The theory behind this approach is that most drivers will travel at a speed that is reasonable and prudent for a given roadway segment. Most U.S. jurisdictions report using the 85th percentile speed as the basis for their limits. However, California law permits jurisdictions to implement and enforce lower speed limits where slower speeds are desired to better accommodate bicycle and pedestrian movement, especially in residential and business districts. Specific criteria regarding building density fronting on a street and a lack of bicycle facilities or sidewalks/paths can be used to justify reductions in speed limits initially set based on the 85 th percentile speed.

What is the 85th Percentile Speed?

The 85th percentile speed is the speed at or below which 85 percent of the motorists drive on a given road unaffected by slower traffic or poor weather. This speed indicates the speed that most motorists on the road consider safe and reasonable under ideal conditions. It is a good guideline for the appropriate speed limit for that road.

Two questions:

- a) Use the Empirical Rule to explain where the “85” in the 85th Percentile Speed comes from. Your answer will need to include both some simple arithmetic as well as prose that explains the relationship between the Empirical Rule and the 85th Percentile Speed.



- b) Open the “Speed Limit Data” link on Canvas. It gives the speed of 100 drivers on a non-residential road in which drivers were focusing only on a safe driving speed; they were not worried about getting a speeding ticket. Establish a speed limit using the 100 speeds in the CODAP file and the 85th Percentile Speed.

2. A coffee machine can be adjusted to deliver any fixed number of ounces of coffee. If the machine has a standard deviation in delivery equal to 0.388 ounce, what should be the mean setting so that an 8-ounce cup will overflow only 0.5% of the time?

3. Most plants cannot withstand a frost, so you need to wait until after the last frost to plant seedlings or seeds. The dates of the last frost are normally distributed.

Freeze / Frost Occurrence Data

All probabilities in whole percent. See notes for probability level description.

- Indicates the probability of occurrence of threshold temperature is less than indicated probability.

State And Station Name	T h r e s h o l d (F)	Spring (Date)			Fall (Date)			Freeze Free Period (Days)			P r o b a b i l i t y (4)
		Probability Level (1)			Probability Level (2)			Probability Level (3)			
		90	50	10	10	50	90	10	50	90	
Massachusetts											
AMHERST	36 32 28	May06 Apr26 Apr17	May23 May10 Apr28	Jun08 May24 May09	Sep01 Sep17 Sep27	Sep16 Sep28 Oct13	Oct01 Oct09 Oct29	140 155 186	116 140 167	91 125 148	50 42 34

Notes:

- (1) Probability of later date in spring (thru Jul 31) than indicated.
- (2) Probability of earlier date in fall (beginning Aug 1) than indicated.
- (3) Probability of longer than indicated freeze free period.
- (4) Probability of Freeze/Frost in the yearly period (percent of days with temperatures at or below the threshold temperature).

Source: National Climate Data Center, Freeze/Frost Occurrence Date,,
<https://www.ncdc.noaa.gov/climatenormals/clim20supp1/states/MA.pdf>

- a) Use the information above to determine mean and standard deviation of the date of the last spring frost in Amherst for 32 degrees Fahrenheit.
- b) What is the spring date associated with a 5% probability level?