**Assignment: Magnetic Fields**
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1. **To facilitate traffic flow, many stoplights now have a sensing system based on inductance to determine if a car is waiting at a red light. If that is the case, the light is then switched to green. Using credible sources, write a paragraph explaining how the system works. Include any in-text citations along with a reference list in APA style. (10 marks)**

Traffic signals may detect the presence of cars or pedestrians in a variety of methods, one of which is by the use of an inductive loop system buried approximately 50 mm below the ground. The system is made up of a coiled wire in the shape of a loop. ("Chapter 2, Traffic Detector Handbook: Third Edition—Volume I - FHWA-HRT-06-108") When a vehicle with a metallic property passes over or stops, this loop is utilized to monitor the change in the magnetic field. When a vehicle drives over or stops on the sensor, the loop detects the presence of the vehicle by measuring the change in the magnetic field. This is achievable because the vehicle has the ability to lower the loop's inductance. ("How Does a Traffic Light Detect That a Car Has Pulled up and Is Waiting for the Light to Change?") The traffic light receives a signal indicating the car is waiting at a red light when the detector detects a drop in inductance for more than 4 seconds. (How are Vehicles Detected at Traffic Signals) This sensing technology is useful because it can handle traffic that has been stalled for a long time and deliver cars in a timely manner.

2. **A 3.00 m long straight copper wire has a current of 9.0 A in it as it passes through a magnetic field. The magnitude of the force on the conductor is 2.00 N. The angle between the current and the magnetic field is 60.0°. What is the magnitude of the uniform magnetic field? (5 marks)**

- Let length of copper wine L = 3m, current I = 9.0A, the magnitude of the force F = 2.0N

  $F = I(\rightarrow_L \times \rightarrow_B)$

  $|\rightarrow_F| = B \bullet I \bullet L \bullet \sin\theta \ (where\ B = magnetic\ field)$

  $B = \frac{F}{IL \bullet \sin\theta} = \frac{2.00N}{(9.0A)\times(3.00m)\times\sin 60^o} = 0.086T$

  Thus, the magnitude of the uniform magnetic field is $8.6 \times 10^{-2}T$.

Works Cited

"Chapter 2, Traffic Detector Handbook: Third Edition—Volume I - FHWA-HRT-06-108." *Www.fhwa.dot.gov*, www.fhwa.dot.gov/publications/research/operations/its/06108/02.cfm.

How are Vehicles Detected at Traffic Signals. "How Are Vehicles Detected at Traffic Signals?" *Traffic-Signal-Design.com*, 2021, www.traffic-signal-design.com/vehicles-detected.htm.

"How Does a Traffic Light Detect That a Car Has Pulled up and Is Waiting for the Light to Change?" *HowStuffWorks*, Apr. 2000, auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/how-does-a-traffic-light-detect-that-a-car-has-pulled-up-and-is-waiting-for-the-light-to-change.htm.