Non-Intrusive Traffic Monitoring System (NTMS)

The Spectra Research NTMS is a portable, accurate, non-intrusive sensor for monitoring multi-lane traffic from the side of highways. The NTMS consists of two identical laser radar (LADAR) channels (separated by 1.0 ft) and contained within an enclosure which serves as an optical platform and protection from the elements. The NTMS sensor emulates two road tubes or tape switches per lane for 1 to 4 lanes of traffic. The NTMS interfaces to the auxiliary port (tape switch input) of an existing traffic monitoring device such as the Diamond Phoenix or equivalent device. The sensor is designed to operate on the road shoulder, 10-15 feet from the nearest lane of traffic. The sensor is non-intrusive and eliminates the need to install road tubes, loops or tape switches within traffic lanes, minimizing traffic delays and hazard to traffic engineers.

Theory of Operation

Two infrared (905 nm) eye-safe laser transmitters, horizontally separated by 1.0 ft, emit pulses which are reflected from wheels of vehicles passing in each lane. Each transmitter has a co-located receiver, optically aligned to receive only the pulses in line with the receiver. Each laser channel emulates a "trip-wire" for wheels/tires of passing vehicles analogous to two parallel road tubes or tape switches in each lane. The NTMS processor also determines the range or lane of each vehicle by measuring the round trip time of flight of the pulses. By means of the two parallel laser beams, the processor also measures the time of arrival of each vehicle wheel in each lane. As each vehicle passes, the sensor processor provides return pulses for each wheel in the appropriate lane as would be the case for tape switches or road tubes installed in each lane. These pulses are fed to the host counting device auxiliary input by means of a single cable. The host traffic monitoring device cannot distinguish between the laser sensor and other commonly used sensors, and processes the information resulting in collection of data such as speed, axle spacing, number of axles, etc.

Setup and Operation

The non-intrusive setup and operation increases safety and reduces stress for traffic engineers who collect field traffic data. Nominal setup time is 15-30 minutes to place and level the sensor for collecting data in 1-4 lanes.

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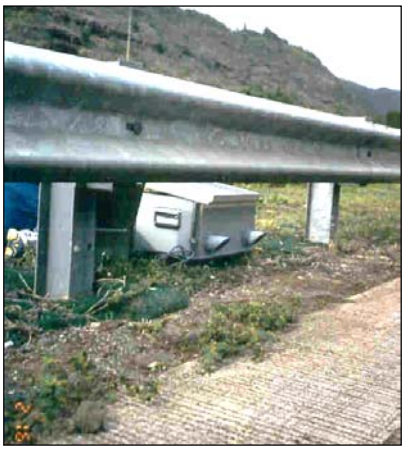
Typical setup consists of :

- Site selection
- Aligning and leveling the sensor
- Setting offset control panel switches
- Attaching interface cable to the host device
- Verifying operation

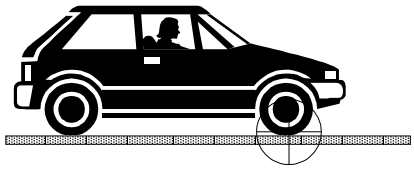
Site Selection

These photos show typical sites which have been used to collect data. It is advantageous to select a level spot which is 10-15 feet from lane one (nearest lane of traffic) and near the end of a guard rail or other fixed device to which the sensor and host can be attached to prevent theft or vandalism. The top of the NTMS can be locked to prevent tampering with the controls during unattended operation.

Sensor Placement and Leveling



Once the site has been selected, the unit is placed on the ground 10-15 ft from the nearest lane of traffic. Three adjustable legs with movable footpads are used to align the box so that the laser beams from both channels "skim" the road surface and align with tires from passing vehicles. Since the laser beams are not visible, a detachable alignment scope (with horizontal cross hairs in line with the beams) is used to aim the beams. A small 2-axis level is supplied with each unit and is mounted on the top panel near the controls. This level is used as a reference during setup.



Setting Control Panel Switches

Setting the control panel switches is fast and simple. Three rotary switches are used to set road offset (distance in feet from the sensor to the nearest lane of traffic-usually 10-15 feet), lane width,-normally 12 feet and number of lanes to be monitored (1 to 4) lanes.

Interface of Host Device

A 3 ft cable connects the NTMS sensor output to the host auxiliary input connector. The host device must be programmed to collect the traffic data in the desired format i.e. Raw, Binned, Count, or Sensor.

Control Panel Indicators

Two columns of four red led indicators (Sensors 1&2, Lanes 1-4) provide a visual indication of a tire passing through the laser beam for each laser channel. Observing these indicators as vehicles pass through the laser beams during setup gives an indication that the sensor is operating properly. Connecting the sensor to a host auxiliary input port permits traffic monitoring in each lane in real time. A laptop computer can be attached to some host traffic monitoring devices for real time monitoring during data collection.

As a power saving feature, the led indicators will not flash after approximately 3-4 minutes. Pushing a small "Test" button near the indicators will reactivate the indicators.

Host Equipment

The NTMS is a sensor and must be connected to a host device for raw data processing and storage. The host device must be able to process high speed, high volume data from four lanes of traffic with a sensor spacing of one foot. Spectra Research has collected data with the Diamond Phoenix unit using the auxiliary tape switch input port. A similar unit made by IRD (International Road Dynamics, Inc.) may also be a candidate host device.

Data Storage Collection

No data is stored in the NTMS sensor. All data is stored in the host device in the format established during the configuration of the device. Extraction of the data is in accordance with the instructions provided with the host device.

Data accuracy is dependent upon the configuration of the host device, the spacing of the sensor beams (1.0 ft) and the performance of the processor in the host device with sensors spaced one foot apart. Typical speed accuracy is ± 2 mph and axle spacing within ± 0.5 ft.

Occlusion Errors

The probability of errors due to the laser beam being blocked by more than one vehicle passing in front of the beams is low. Exact wheel alignment must take place for the nearest wheel to eliminate detection of a wheel in the next lane. At high speeds, detection of a wheel takes place on the leading edge of the tire. Once a legitimate target has been detected the sensors are reset for the next tire.

Prior to proceeding with the development of the NTMS, S*R conducted an occlusion study (July 1996) to determine how often occlusion might occur. Assuming a three-lane highway, a per-lane vehicle rate of 2200 vehicles per hour, a mean vehicle speed of 60 mph, a mean tire diameter of 2 ft, and an average of three axles per vehicle, the analysis predicted a vehicle error rate of less than 2%.

Temperature

The NTMS is designed to operate over the industrial temperature range of –20°C to +85°C.

Power Requirements

The NTMS requires 12 VDC at 1.5 Amps. The unit has a 12 V, 33 Ahr battery installed and will operate unattended for approximately 20 hours at a temperature of 80° F without solar augmentation.

Battery Charging

A 750 mA solar panel with reverse diode protection is mounted on the top cover of the NTMS to augment the battery and extend operating time. The number of hours gained by solar augmentation depends on the position of the panel relative to the sun, cloud cover, ambient temperature, etc. An external connector is provided for battery charging or adding an additional external battery.

Construction

- Machine gray weather-resistant aluminum enclosure
- Dimensions 21”X21”X 12”
- Weight 70 lbs

Spectra Research reserves the right to this product or its published technical data at anytime and without notice.

For further information, please visit our website at www.spectra-research.com or contact:

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