# Weighing of Moving Vehicles using FOPS©

**System Capabilities**

Vehicular weight measurement while the vehicle is in motion has a significant application in traffic monitoring and weight regulation. While a conventional weighing scale requires vehicles to be sidetracked to a weighing scale, the current on-line system can provide a means of instantaneous measurement while the vehicle is moving. While extensive testing is required to get this certified, it can at the present moment be implemented for traffic monitoring and for suspect vehicle predetermination. This would improve the throughput of heavily laden vehicles. In addition, the system has capabilities of measuring the vehicular speed and tyre pressure. Possibly with further testing and evaluation, other parameters might be obtained as well.

**System Features & Functions**

The basis of this system is a Fiber Optic Polarimetric Sensor (FOPS) developed and packaged within the Sensors and Actuators Programme in the School of Mechanical and Production Engineering. The system has been used for health monitoring of structures made of metals, composite and concrete. The sensor is based on the principle of change in polarization of the light transmitting through the fiber when subject to external perturbation. The system is capable of static, transient and dynamic measurements. The packaged system shown in the photograph comprises an illumination module and a demodulation module. The two ends of the sensing fiber can be plugged into the system through the input and output ports and the system is ready to go. A laser diode is used to inject polarized light into the fiber, which is then demodulated, using a single or dual detector mechanism. The output is then displayed on the oscilloscope or can be input to a computer for analysis and display by using a user friendly GUI interface.

**System Design**

For the weighing of vehicles in motion, the sensing system comprises a length of fiber which terminates onto a weighing pad (see photograph). This design enables the measurement of single wheel at a time as it passes over the pad. Other designs can be implemented for the weighing of all the axles for a complete weight measurement system. A typical wheel signature as it passes over the pad is shown in the graph. From this various parameters can be determined. The weight on the particular axle can be determined from the number of intensity cycles. Low or high tyre pressure will change the signature at the central part. The speed of the vehicle can be deduced from the duration that the sensor has been active. Note that there is a sharp cut-off at points where the wheel enters the sensing area and when it leaves the sensing area.

**System Applications**

The current system, while portable, is to be further miniaturized to incorporate the laser driver and the processing and display electronics within the sensor unit. For further applications, field-testing and implementation, please contact

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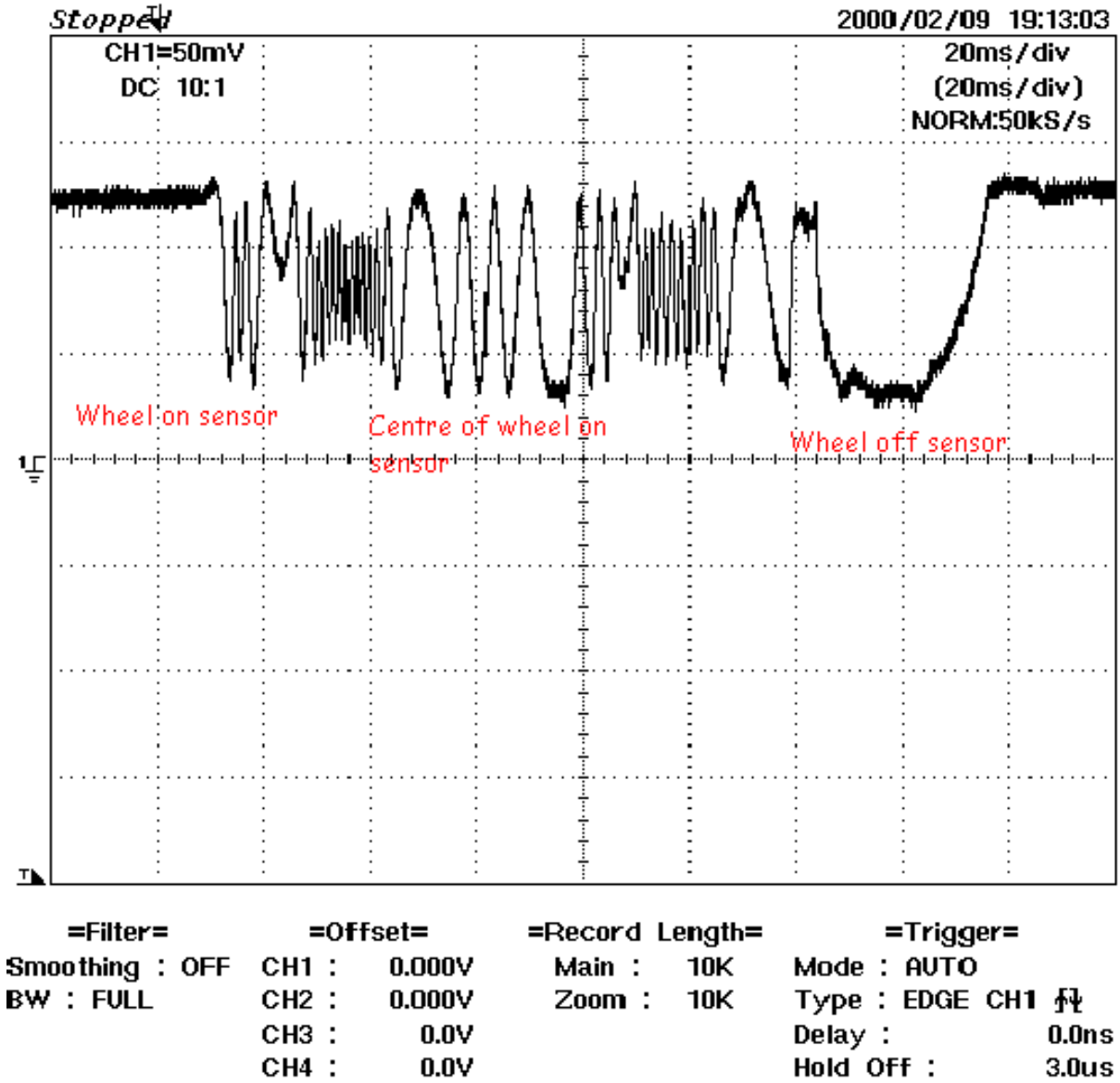
**Fiber Optic Polarimetric Sensor - Illumination and Demodulation System**


**Test system of FOPS for On-line Weighing of Vehicles**

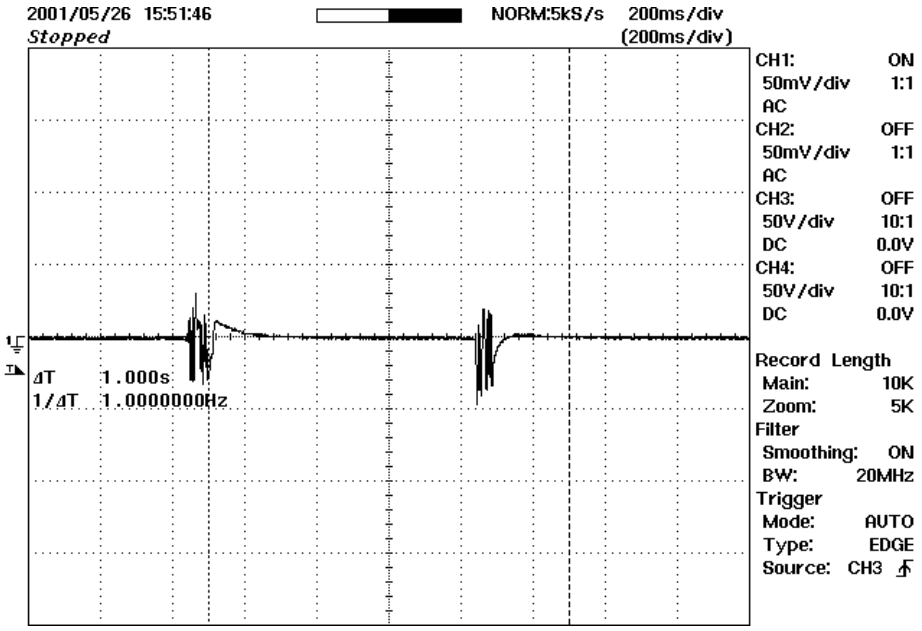



Typical Oscilloscope response from a car passing over the sensor at a speed of 10Kmph

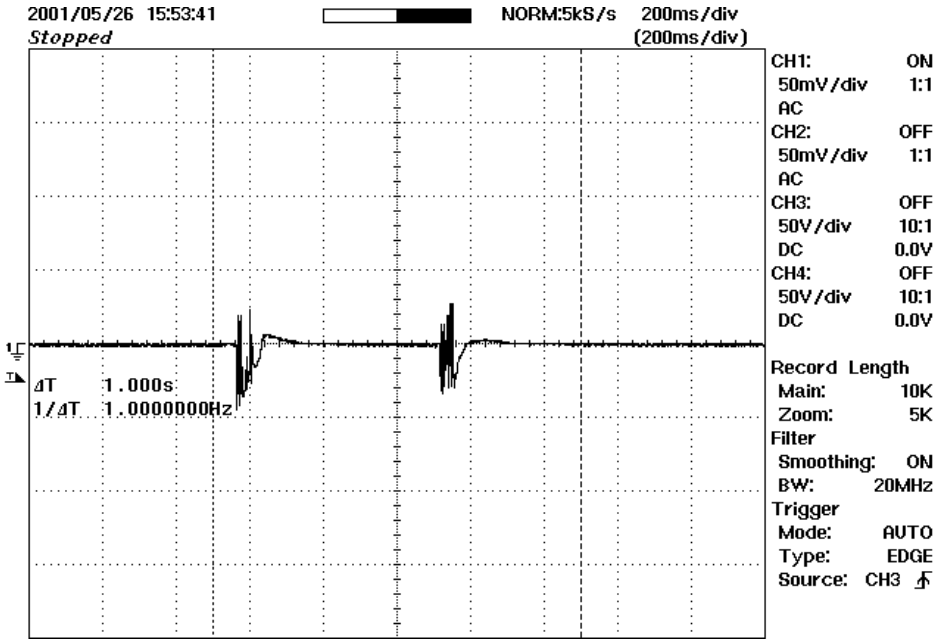
# Vehicle experiment with Low Birefringent Fiber

Car with two wheels moving on the sensor at different speed

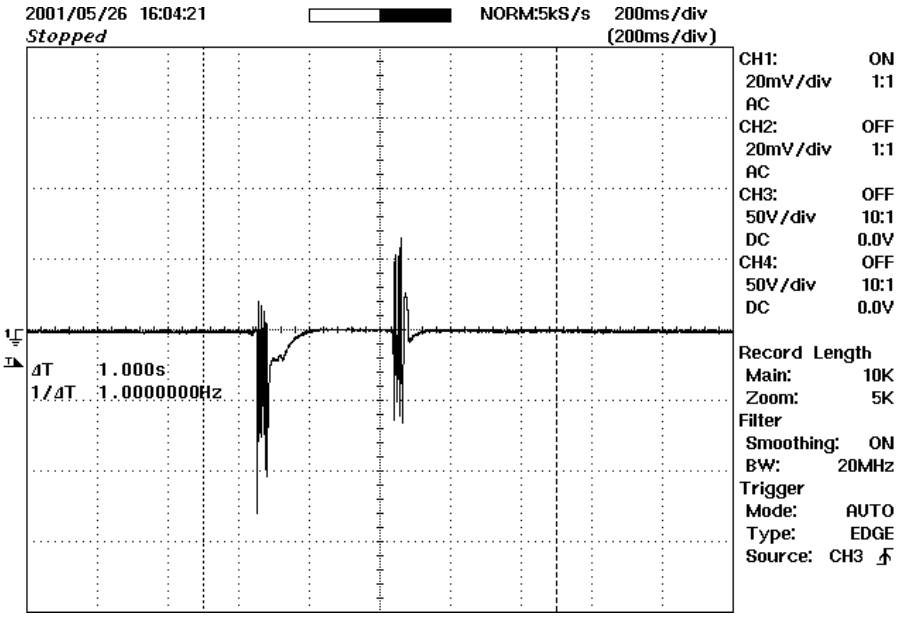
1. Speed 10Km/hr



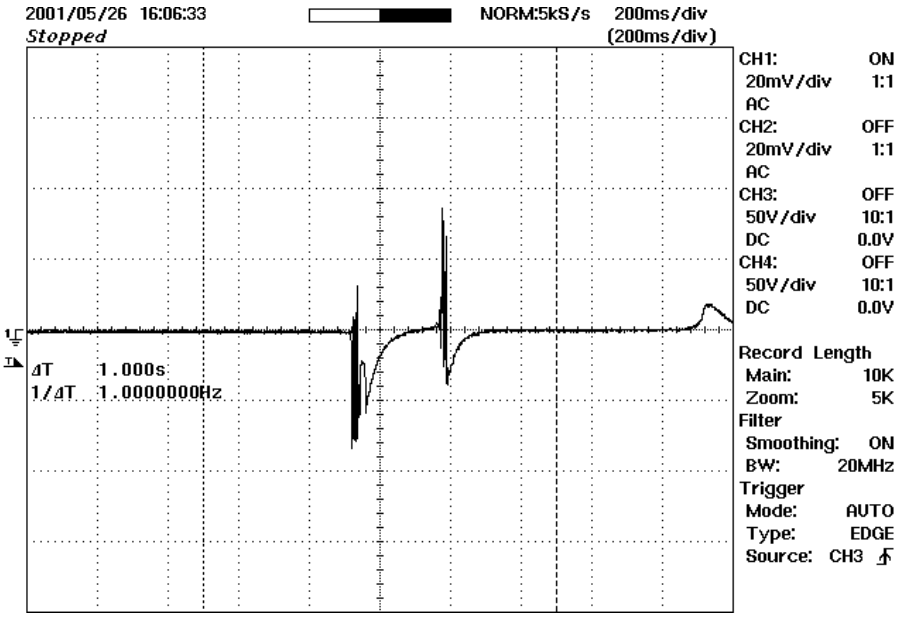

2. Speed 20 km/hr



3. Speed 30 km/hr

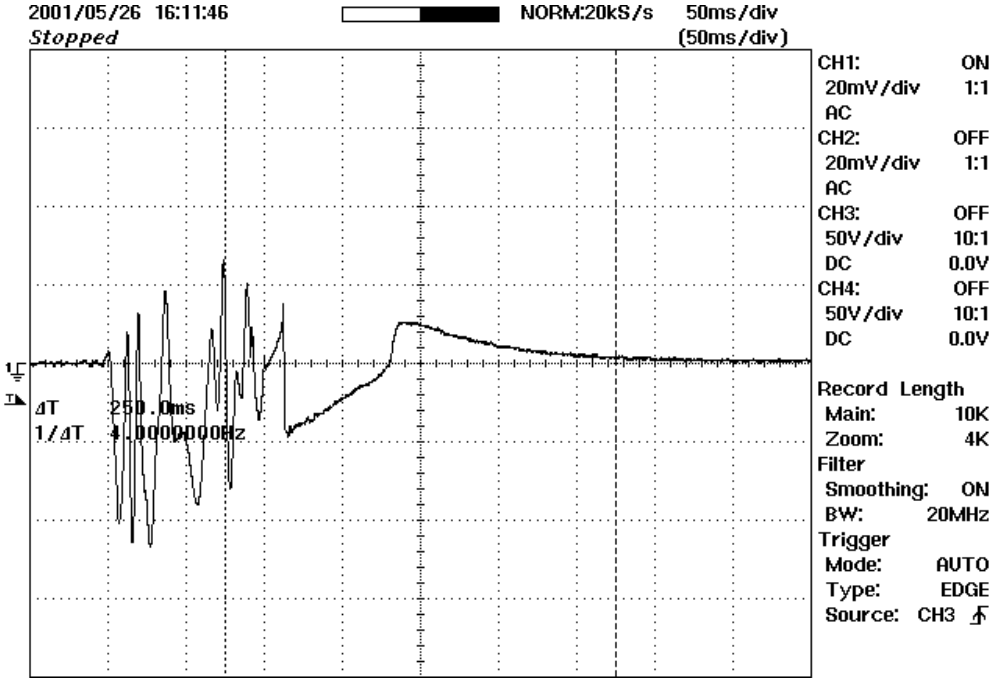



4. Speed 40 km/hr

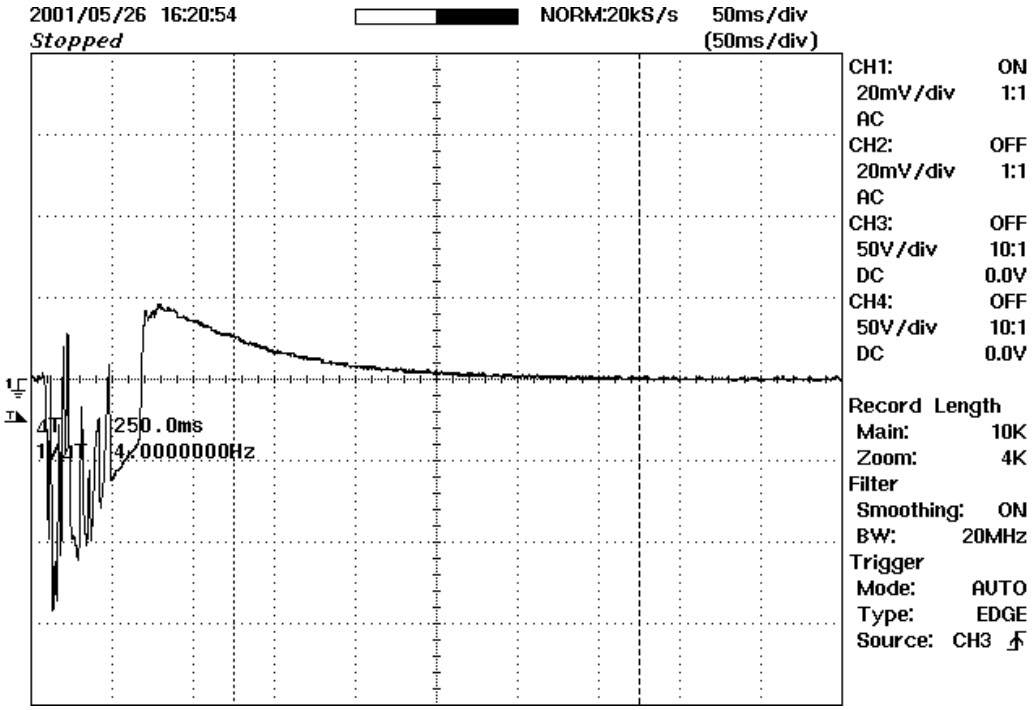


One wheel on the sensor

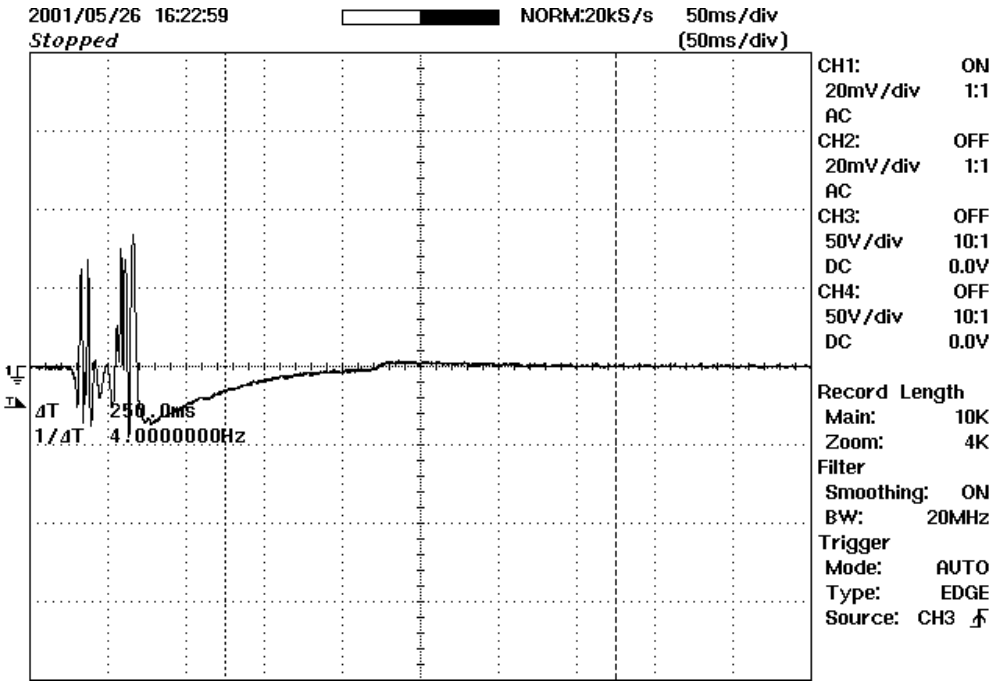
1. Speed 10 km/hr



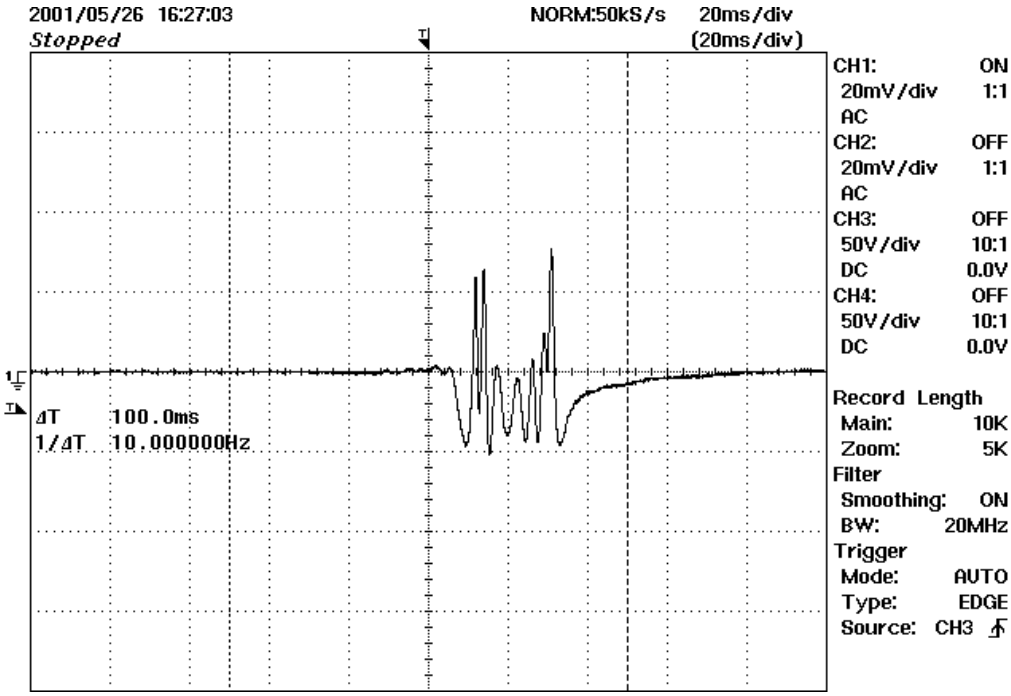

2. Speed 20 km/hr



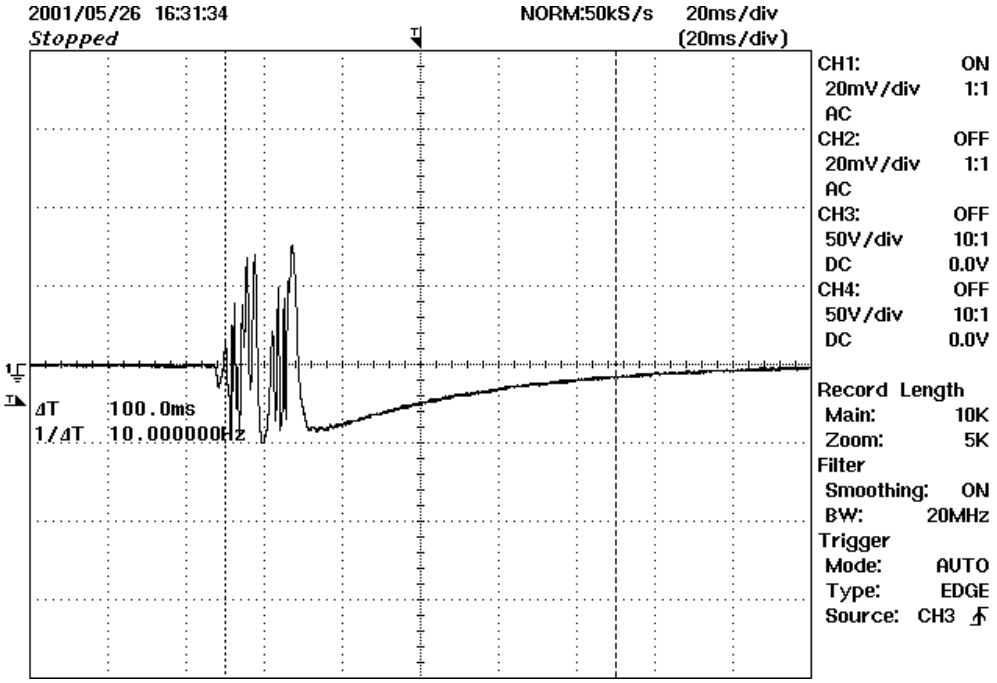
3. Speed 20 km/hr (repeated)




4. Speed 30 km/hr

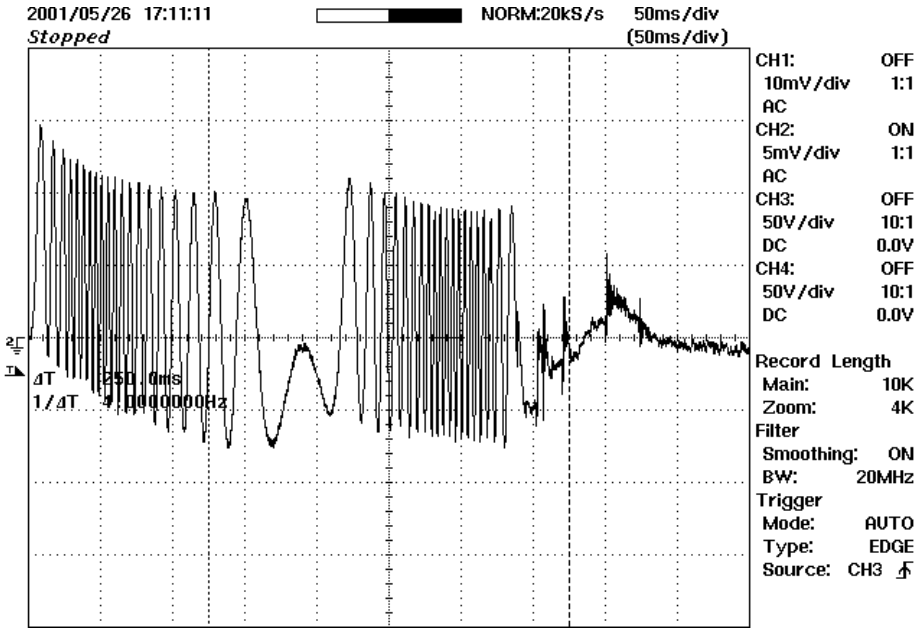


5. Speed 40 km/hr

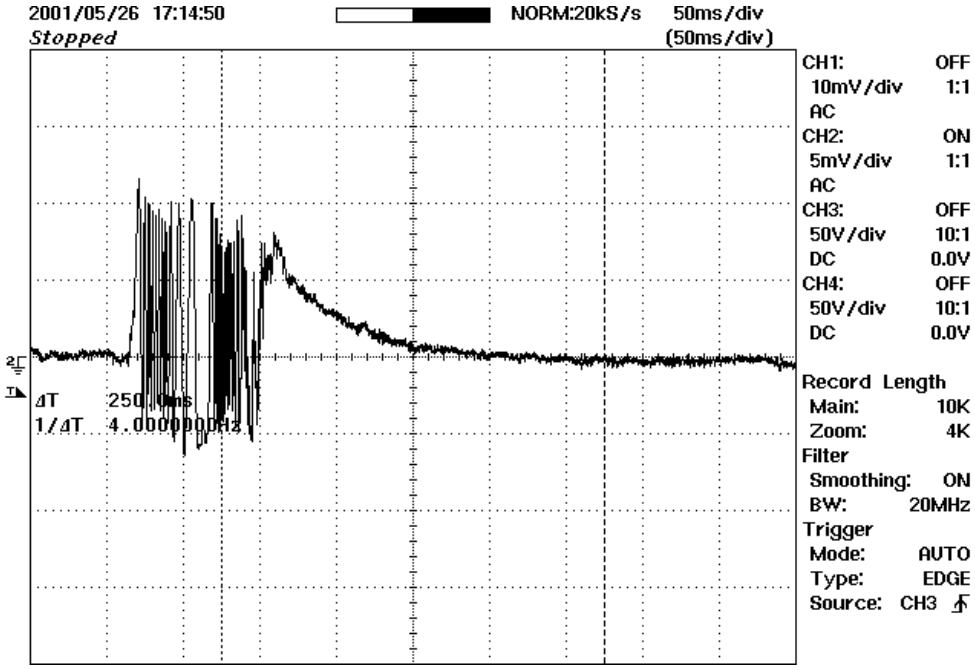


**Vehicle experiment with High Birefringent Fiber**

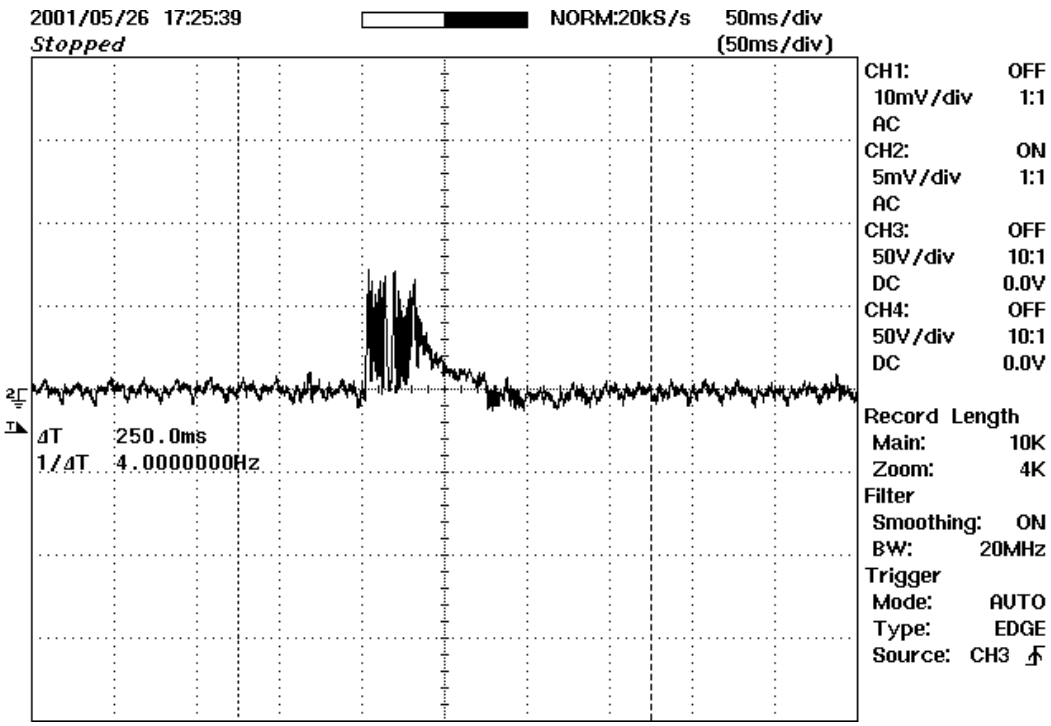
One wheel on the sensor
1. Speed 5 km/hr



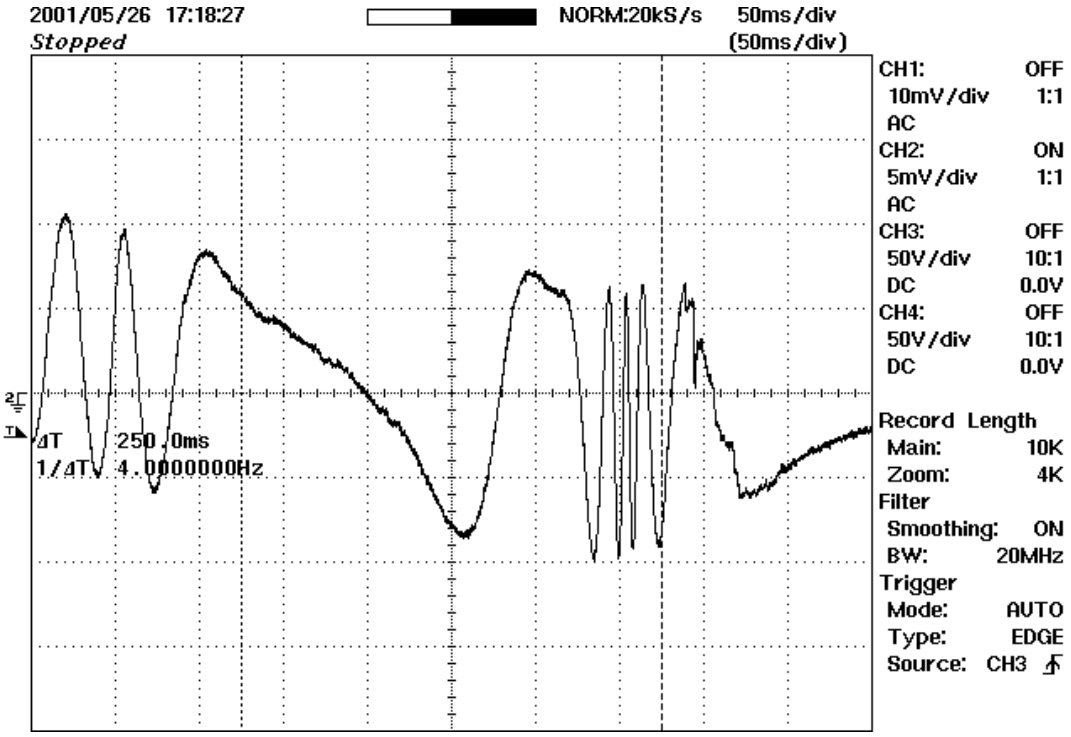

2.Speed 10 km/hr



3. Speed 20 km/hr

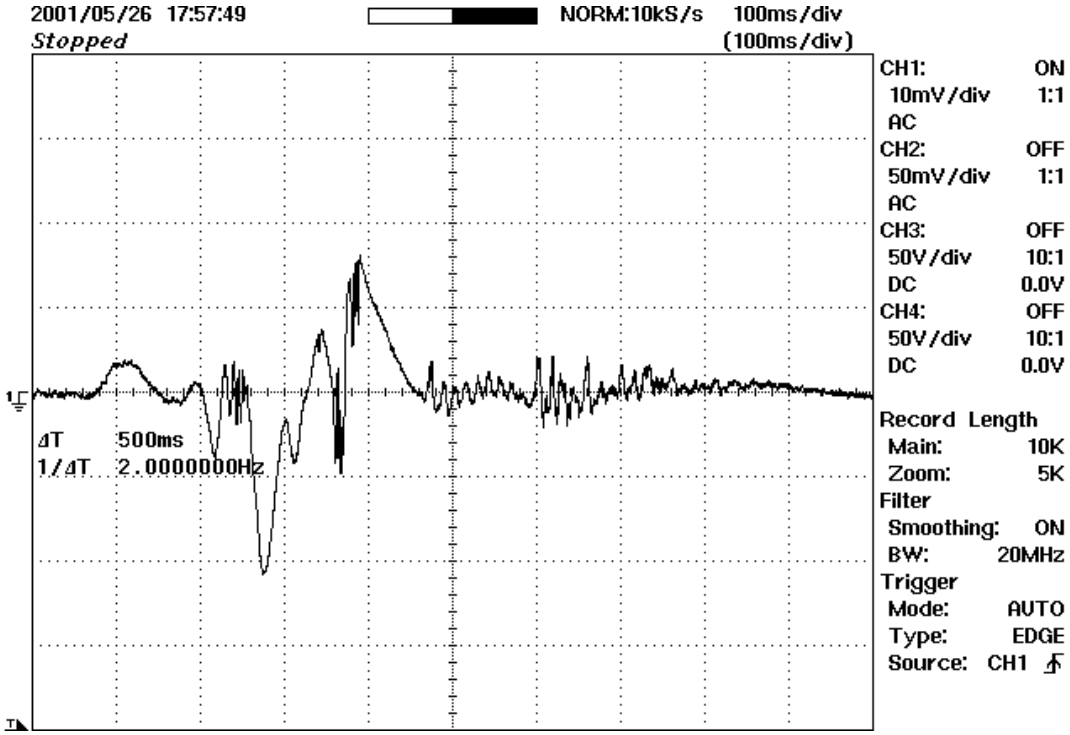


**Experiment with truck at a speed 5 km/hr and HiBi fiber as sensor**

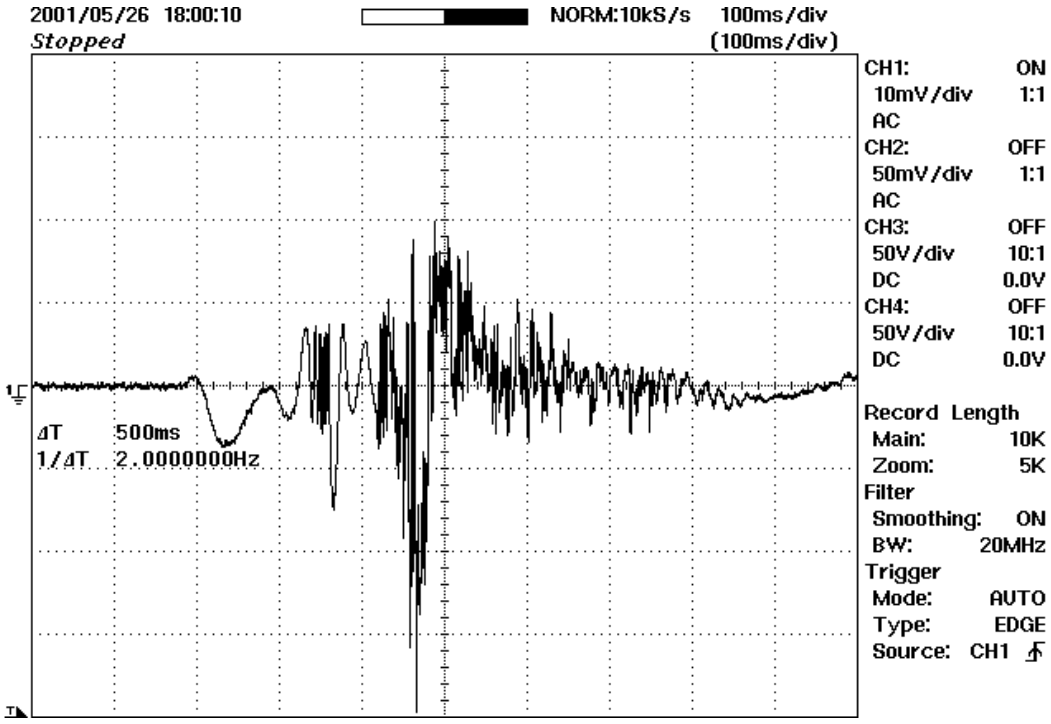


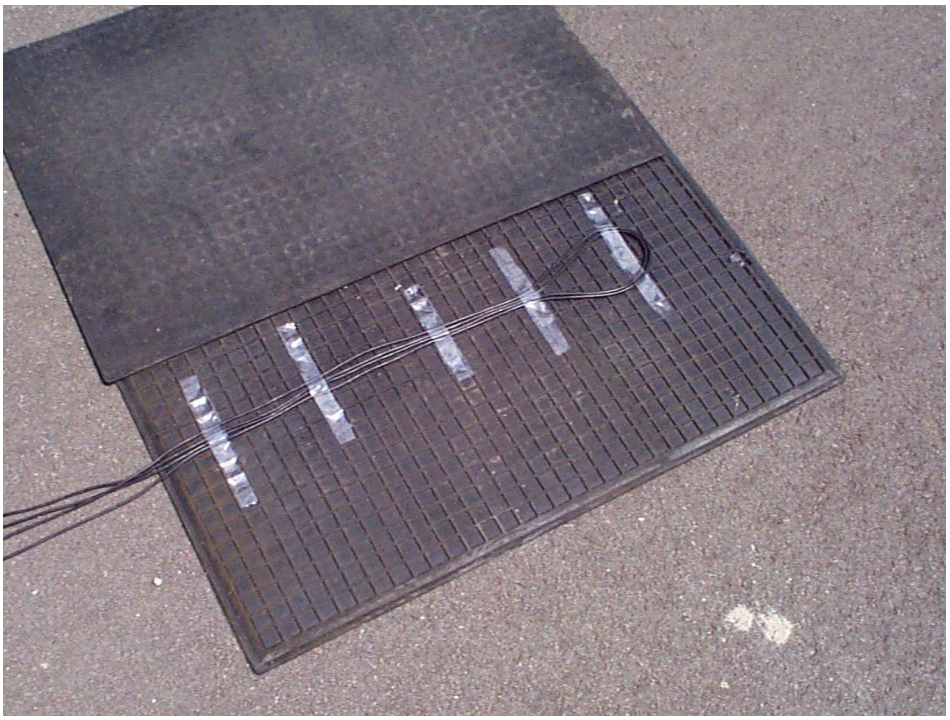
**Experiment with car on Bridge**

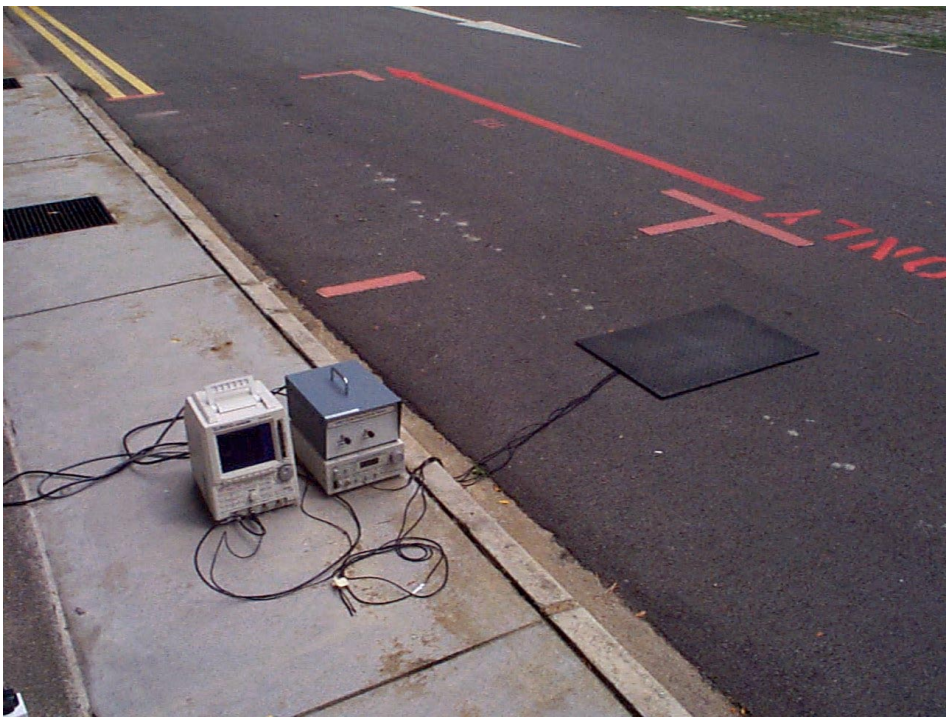
Experiment 1




Experiment 2





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