February 1974 B73-10436

NASA TECH BRIEF

Langley Research Center

System for Measuring Passenger Reaction to Transportation-Vehicle Vibration

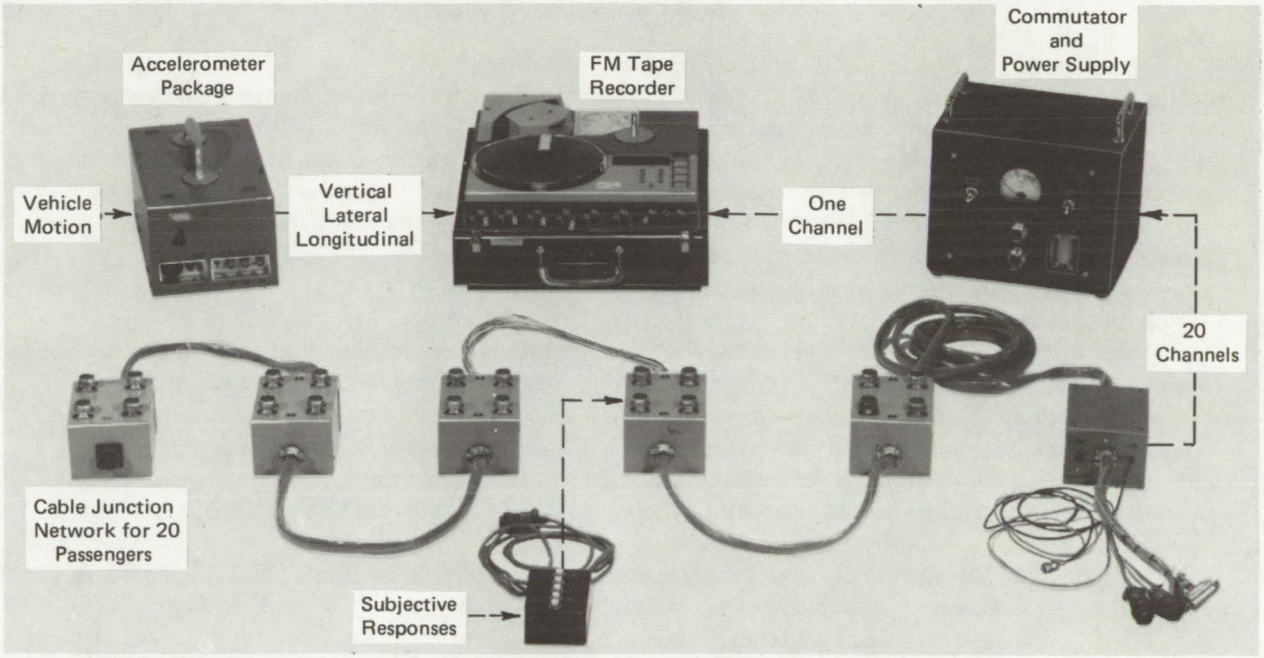

Figure 1. System for Vehicle Motion and Subjective Response Measurement

A system has been developed and is being used at Langley Research Center to measure and record passenger response to the vibration of transportation vehicles. The equipment now used will measure the reaction of 40 passengers, with this number being limited only by commutator size. It is capable of measuring frequencies from 0 to 50 Hz and is portable, light, inexpensive, and easily adaptable to field operations. The capability of the system to record simultaneously, on magnetic tape, the relationship of passenger reaction and vibratory response of the vehicle permits better determination of passenger comfort; and it allows fast and efficient handling of the data for adaptation to existing digital computer-program processing methods. This system also could be used in situations where it is necessary to record simultaneously subjective response to other types of physical measurement or stimuli, such as temperature, noise, or pressure.

The components of the system are shown functionally in the photograph (Figure 1) and in the block diagram (Figure 2). These consist primarily of an accelerometer unit; a 45-channel commutator; a biasing unit; a seven-channel FM tape recorder; a power supply; and hand-held, passenger subjective-response units. The self-contained trilinear accelerator unit measures the low-frequency random vibration of interest produced by the transportation vehicles. It consists of three vibration transducers (28-volt servoaccelerometers sensitive to 0 Hz), oriented perpendicularly. The electrical outputs of the transducers, used to measure the vibratory response of the vehicle, are recorded on the tape recorder. The passenger, subjective-response units initiate

(continued overleaf)

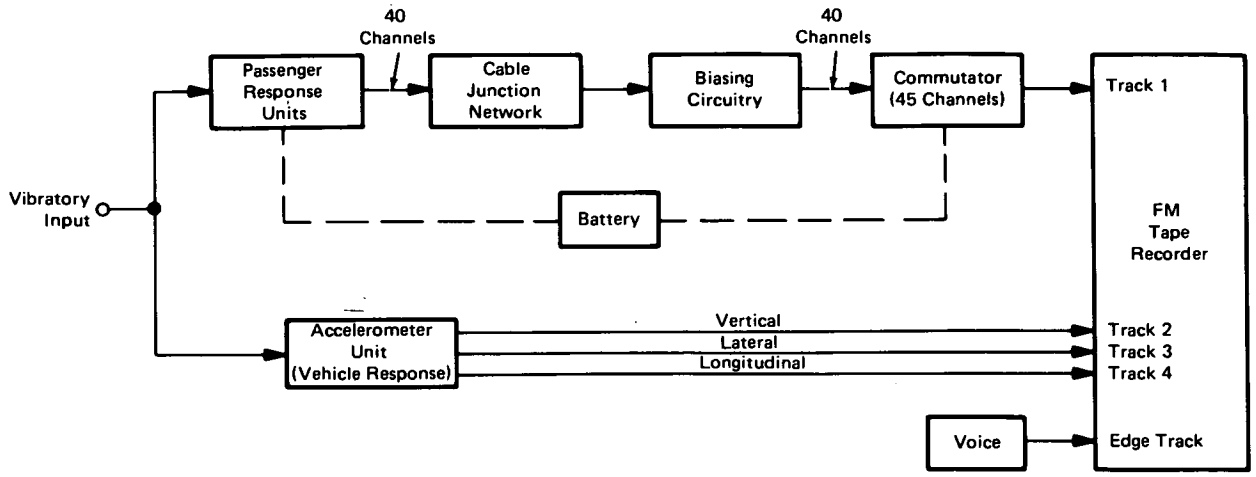

Figure 2. System Block Diagram

low-impedance dc voltage signals from numbered push-buttons. The signals are provided in five discrete voltage steps for data purposes and in one negative voltage step for zero reference. The pulse-duration modulation-type commutator receives the signals from the response units, after they have passed through the biasing unit, and releases them to the recorder as electrical pulses, proportional in width to the discrete dc voltage signals received.

As the system is placed in operation, the tape recorder commences recording the vertical, lateral, and longitudinal vibration of the vehicle. Signals, which represent passenger reaction to this vibration, are initiated by buttons on the subjective-response units being depressed. These signals are passed through the biasing network, to prevent spurious signals and random noise from affecting the signals during data commutation, and then to the commutator. The commutator samples each subject channel at the rate of 2.5 times per second, identifies each station per sample, and passes the signal on to be recorded on the tape recorder. The tape recording provides a time history of the data as a continuous recording of vehicle vibration; and, in direct relation to this, there are a total of 112.5 identified passenger-response samples per second also recorded.

Note:

Requests for further information may be directed to:

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Patent status:

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