

APL

- Continuous measurement of longitudinal evenness -



APL System - Lengthwise Profile Analyzer - allows the continuous measurement of longitudinal roughness of road pavements and aircraft runways and, more generally, any roadway usable by motorized vehicles, regardless of pavement structure and the nature of its coating.

The measurement is based on a survey of the lengthwise profile of the roadway, in one or two tracks: the analysis of this profile allows to infer the roughness characteristics of the roadway surface.

APL is the newer version of this device, designed by IFSTTAR and widely used since then in France and around the world.

Overview

The profile reading sensor is a light single wheel trailer type device comprising:

- One non suspended wheel carrier arm made of a light alloy, in which the pendulum system is implemented



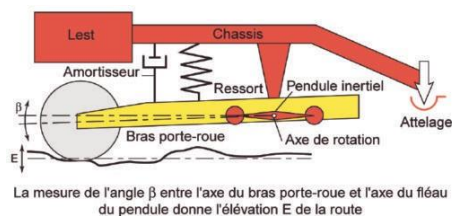
- that measures the magnitudes of changes in profile and the location sensor of their positioning,
- The light cycle type wheel whose circularity and balancing are thoroughly checked.
- A machine-welded tubular chassis, weighted, suspended by means of a spring-damper sized to ensure a constant response throughout the entire device bandwidth. It is equipped with the signage components in accordance with the applicable rules. The electronics-computer module, installed in the towing vehicle is a unit equipped with a microcomputer and the all the electronic elements necessary for treating and acquiring the signal. The operator position is equipped with a flat touch screen and a combined keyboard and mouse, the driver having a specific display.

Principle

The sensor consists of a trailer connected to a towing vehicle via a gimbaled linkage. The profile's roughness defects are translated into electrical signals by a double transformation:

- The trailer represents a "vehicle quarter" assembly with the wheel axis continuously following the roadway profile thanks to its ballasted chassis and a suitable suspension. Vertical motions E of the wheel axis translates into angular deflections β of the wheel support arm.

Schéma de principe



- A low-frequency pendulum forms the basis of the inertial reference against which the angular deflections of the wheel support arm are measured and then translated into profile elevation values. The function of decoupling the pendulum allows minimizing the effects of vertical excitations of the towing vehicle. The result of the measurement leads to reading the roadway profile along the roadway, in one or two tracks usually located in the traffic lanes. The system, with one or two trailers, is controlled and managed by electronic acquisition specialized on-board in the tractor vehicle. It produces files of numerical values of the magnitudes of the dropoffs of profiles identified with a longitudinal pitch of 0.05 m (2 in). The wavelengths contained in the profile read by APL depends on the measurement speed. At the rated speed of 72 km/h (44.7 mi/h), APL reads without distortion or attenuation of the wave lengths between 0.7 m (2.75 in) and 50 m (164 ft).

Features

Metrological characteristics

- Vertical amplitude: ± 80 mm (3.15 in), resolution ≤ 0.1 mm (0.004 in),
- Horizontal Distance: resolution < 0.05 m (2 in), precision $\leq 0.1\%$,
- Bandwidth frequency: 0.4 Hz – 30 Hz,
- Measurement speed: from a few km/h to 144 km/h (89.5 mi/h),
- No longitudinal acquisition: 0.05 m (0.16 ft)
- Volume of measurement files: single or dual track: ≈ 150 kB/km (93 kB/mi),
- Independence of climatic conditions and roadway state conditions,
- High performance and high-speed measurement (up to 144 km/h (89.5 mi/h)),
- Independence of the type of vehicle,
- Independence of the trailers and the electronics assembly,
- Multiple indexes: virtually all roughness indicators can be calculated (IRI, NBO,...),
- Operation of the measurements in the vehicle or in the laboratory,
- Varied presentation of results: profile graph, table of indicator values, route diagrams,...
- Portability of elevation, profile and roughness indicator value files in text format to any database.

Dimensional characteristics

- Trailer: -Dimensions: L = 2.30 m; l = 0.55 m; h = 1.22 m, L = 1.96 ft; l = 1.31 ft; h = 5.9 ft (signaling included), - Weight: 120 kg (1,808 lbs)



Terms of use

APL can be used interchangeably in single or dual track, alone or associated with other measurement functions (multifunction devices). It can be easily installed on any type of motor vehicle. The APL operation is independent of weather conditions and the wetting state of the surface of the roadway conditions.

Execution conditions and profile measurement surveys using APL operating conditions are defined in test method no. 46 of the LCPC: "Measurement of longitudinal roughness of the roadway and aviation pavements."

They also meet the specifications standards NF 98 218-3 and ISO 8608 and the project of the European standard

on the measurement of pavement roughness. The analysis and editing of the results are carried out either on the test vehicle at the end of the measurement, or in a laboratory.

The APL2000 operating system offers a very broad range of measurement processing modules, allowing:

- The calculation of the main roughness index used in the world,
- Assistance in application of French regulations (bulletin DR 2000- 36),
- The expertise of the measured profiles (spectral power density, analysis of local defects,...).

Applications

Support for the execution of the pavement construction:

- Acceptance check of new pavement layers,
- Evaluation or periodic monitoring of road networks,

- Expertise of specific sections. In addition, the metrological performance of APL allows using it both for operational studies and for research.



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