PAVEFWD FALLING WEIGHT DEFLECTOMETER (FWD)

The Falling Weight Deflectometer (FWD) is a non destructive testing equipment used in pavement engineering for measuring the vertical deflection response of a pavement surface to an impulse load to achieve in situ characterisation of the pavement layer stiffness. The dynamic load applied to the pavement surface by the FWD simulates the magnitude and duration of a single heavy moving wheel.

The FWD utilises a Load Cell and Geophone deflection sensors for precision measurement of pavement layer stiffness which is used to calculate pavement properties such as:
- Bearing capacity
- E Moduli
- Expected or remaining surface life

The PaveFWD is generally configured with 7 or 9 geophone sensors with geophone sensors placed at preset distances with a typical spacing of 200 to 300mm between each sensor to measure the deflection of the surface at high resolution caused by the controlled load pulse wave outward from the to the ground.

The PaveFWD can be configured with 7 to 23 vertical deflection sensors per requirement. Collected information is used to determine surface material strength. The FWD is used on highways, local roads and airport runways. Measurements are recorded at preset distances along the surface when the FWD is stationary. The PaveFWD Complies with ASTM D4694 “Standard Test Method for Deflection with a Falling Weight Type Impulse Load Devices”.

Knowledge of the existing pavement condition is vital to the success of any pavement rehabilitation project. The use of Falling weight Deflectometer plays an indispensable role in evaluating the pavement structural condition.

The goal of lower cost, improved pavement quality demands more precise assessment of the pavement layer qualities, making the in-situ measurement of design parameters like stiffness and modulus necessary. By using the FWD to obtain test results for the above, pavement analysis and design are carried out in a more rational and accurate manner than relying on simple assumptions or engineering judgment. This can lead to crores in construction costs saved, annually on road - pavement projects.

Utilisation of the FWD is recommended per IRC 115 – 2014.

The PaveFWD is offered in both trailer mounted and vehicle mounted options.

Features and Benefits:

Double Axle Chassis offered for 150kN FWD system allowing upgrade to HWD 250kN or SHWD 350kN system.

- Conforming to standards to ASTM D 4694 - 96 & D4695-03
- Automatic controlled load adjustment for greater accuracy
- Ambient, Ground & Asphalt temperature sensors
- Standardised data output file
- In trailer mounted FWD, generator provided as standard.
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Weights installed in configuration of 10kG to allow easy mounting – dismounting of load.

- Digital Geophone: Geophones have programmable circuit board mounted on each geophone to allow store calibration data and serial number of each geophone.
- Digital Geophone eliminate analogue signal degradation.
- Digital geophones allow plug and play of geophones without additional configuration requirement.
- Even in case of accidents for any reason whatsoever, the digital geophone can simply be replaced for immediate equipment usage.
- Self leveling geophones on a pivoting beam for use on uneven ground conditions.

4 way split loading Load cell, 300mm to allow even distribution of load on an uneven surface.

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- Easy to Use Software allows data to be viewed, stored and transferred in PaveFWD output F25 and F20 data, along with CSV, Time History and PDDX – allowing use with any FWD software.

Product Range:

Pave®FWD, Trailer Mounted, 7-150kN
A standard Falling Weight Deflectometer (Pave®FWD-TM) is a trailer mounted non-destructive testing device used to determine the stress/strain parameters of pavements and sub-grades.

Pave®FWD, Vehicle Mounted, 7-150kN
A Falling Weight Deflectometer (Pave®FWD-VM) is a vehicle mounted non-destructive testing device used to determine the stress/strain parameters of pavements and sub-grades.

Pave®HWD / Pave®SHWD,
Heavy and Super Heavy Trailer Mounted, 7-250 + 7-350kN
A Heavy Falling Weight Deflectometer, Pave®HWD and the Super Heavy, Pave®SHWD are twin axle trailers used for non-destructive testing of stiff bound material as found on Airport Runways and truck car parks.
How does BACK CALCULATION work?

Back calculation is a complex procedure in which the modulus of each pavement layer is determined. The back calculation of layer moduli helps determine the uniformity of the pavement sections. The major inputs include surface deflection, structural layers’ thicknesses, material Poisson’s ratio and initial moduli estimates. The temperature at the time of testing must be considered in estimating the initial modulus for any bituminous layers.

What is the FWD collected data used for?

- FWD-collected data is used by engineers to determine the backcalculation of layer moduli for pavement design and analysis.
- The compressive strain at the top of the base layer and the tensile strain at the bottom of the asphalt layer.
- These numbers are then used to calculate the remaining number of ESALs the pavement can withstand before reaching its breakpoint of rapidly accelerated deterioration. Along with traffic data it can then be used to determine the approximate remaining pavement life before rehabilitation will be required. An alternative analysis for grossly estimating remaining life can be done on the basis of the deflection measured. The temperature at the time of testing must be considered in estimating the initial modulus for any bituminous layers.

The FWD machine is formed by the following elements

- Load Plate
- Geophones (7-23)
- Load Sensor (150kN)(HWD 250kN, SHWD 300kN)
- Ultrasonic Distance Sensor (for precise automatic drop height adjustment)
- Temperature Sensors (3)
- DMI (Distance Measuring Indicator)
- Global Positioning System
- Ruggedized Laptop

FAQ:

1. **Why FWD is used worldwide as a standard?**
   - Evaluation of routine pavement design.
   - Aid forensic studies.
   - Formulating rehabilitation strategies.
   - Evaluation of superheavy loads and their effect on pavement.
   - Establishing load zones.
   - Formulating pavement management activities at both project and network levels.

2. **Can the FWD be used on both flexible & rigid pavements?**
   - Yes, the FWD can be used to evaluate both flexible pavement for determining the overall structural strength and the individual layer stiffness, and for evaluating the load transfer across slabs to detect voids if any on rigid pavement. It essentially determines the overall deflection along the roadway alignment.

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The trailer chassis has been designed around international highway DoT standards. A twin axle and wide wheel base with drum inertia braking system gives an excellent platform to mount the FWD equipment safely. The twin axle trailer is designed to support extra weight of an HWD or SHWD.