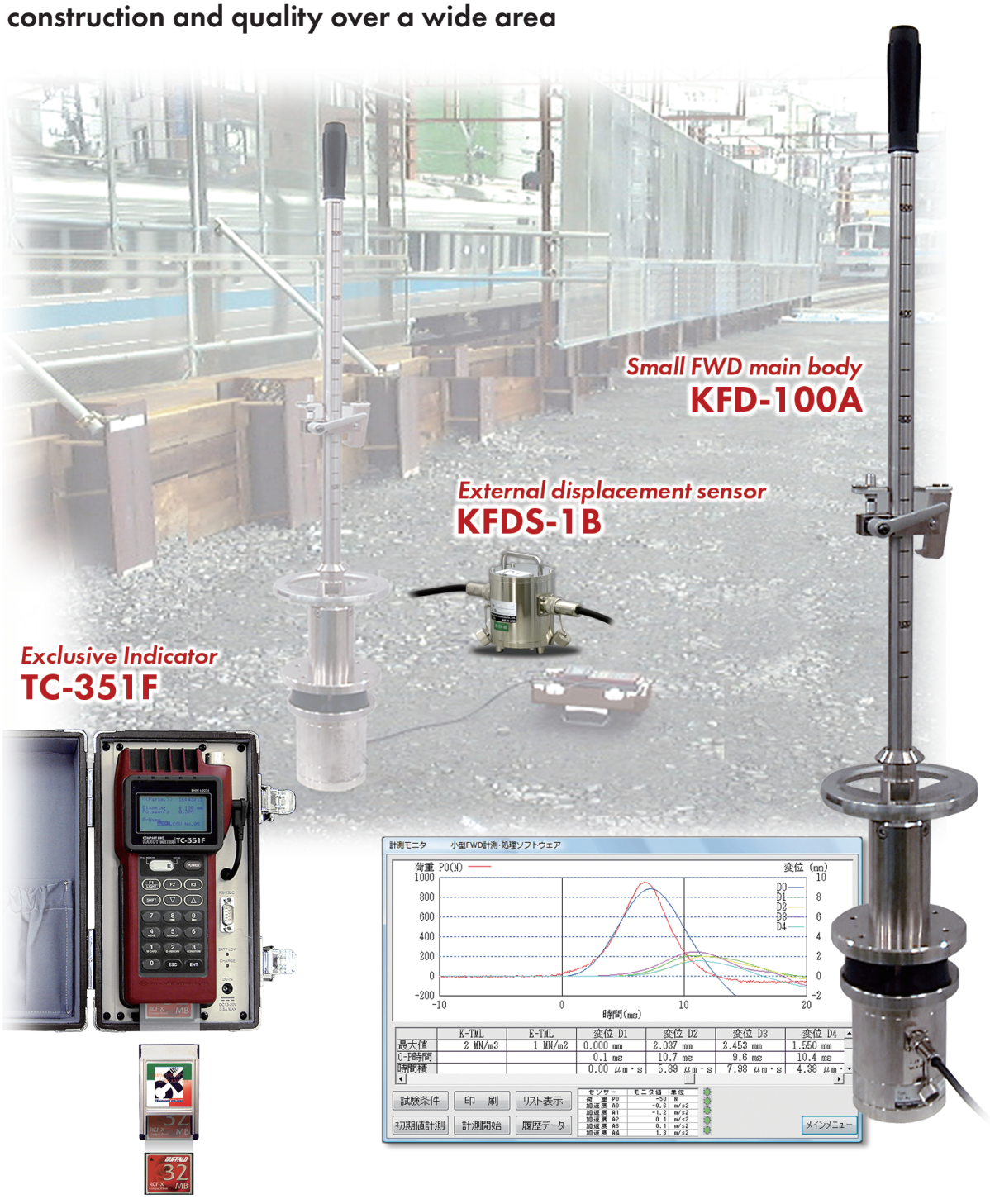
Portable Falling Weight Deflectometer System

TML Small FWD System *FWD-Light®*

Speedy measurement of ground rigidity

Enables reduction of survey costs and control of construction and quality over a wide area



Tokyo Measuring Instruments Laboratory Co., Ltd.

TML Small FWD System

FWD-Light®

What is Small FWD?

Small FWD is a dynamic loading test system for non-destructive measurement of stiffness for soil structures such as embankments, cuttings, roadbeds, and roadbeds in a short period of time.
The compact FWD system "FWD-Light" can measure the coefficient of subgrade reaction (K-value), which is necessary for evaluating soil stiffness, and the coefficient of deformation (E-value), which can be converted to CBR or uniaxial compressive strength.

Feature

-No reaction force device for loading is required.

-It is compact, lightweight, easy to handle, and portable.

-Test results are immediately displayed and stored on site.

-A large amount of data can be acquired in a short time (approximately 10 minutes per survey point).

-Fields can be managed in terms of planes rather than dots.

-Conventional ground stiffness evaluation values (K-values and E-values) are obtained.

-Battery operation allows measurements in a variety of field environments.

-There is no artificial variation due to testing experience or individual differences.

-Economical and rational construction and quality control is possible.

Operating Procedure

1) Preparation

The small FWD main body is placed on the surface to be measured and connected to a dedicated display unit.

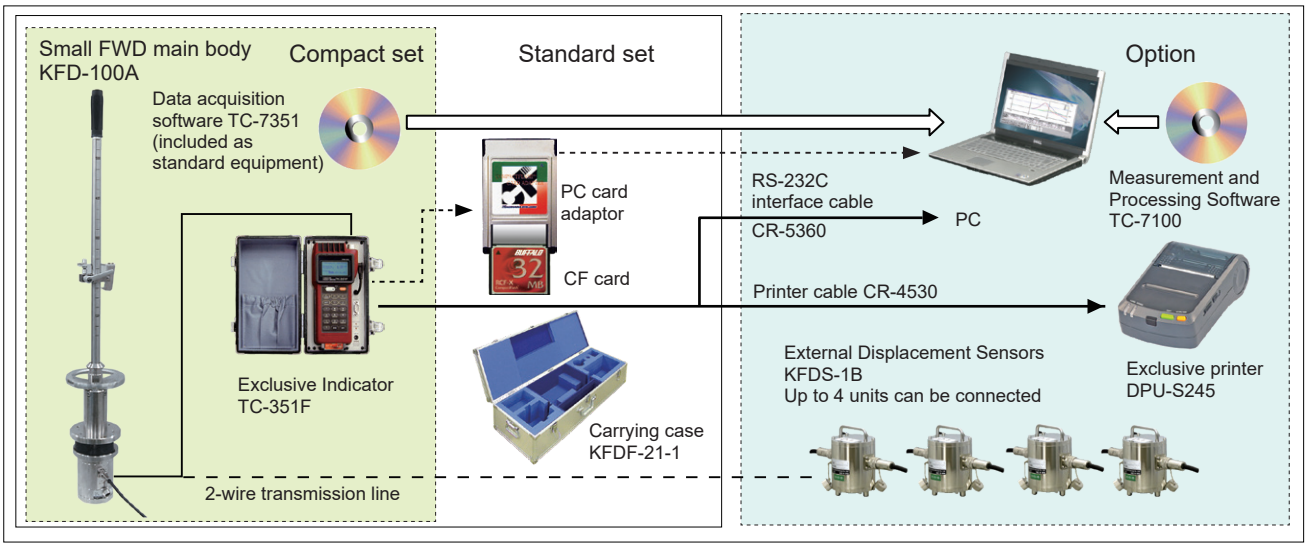
2) Measurement

Lift and drop the deadweight to the deadweight dropping device fixed in place.

About Principles

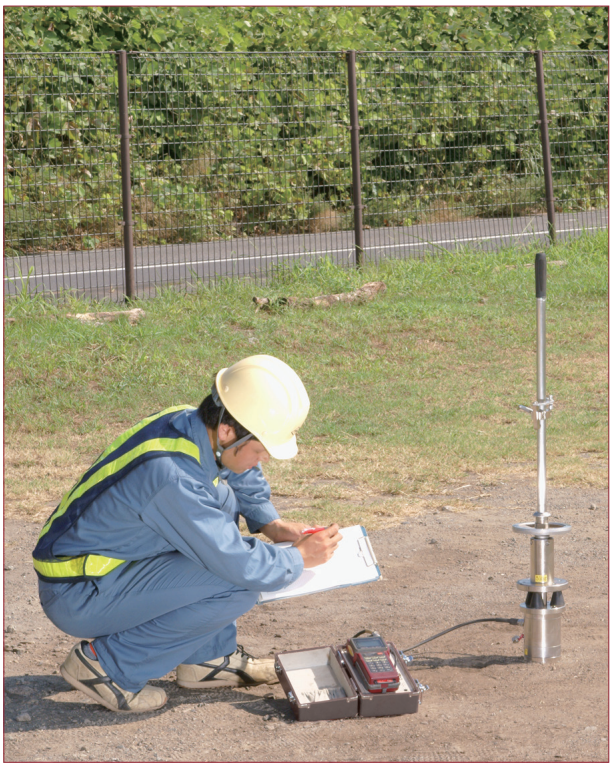
This device measures the impact load and displacement generated by lifting a weight to a predetermined height and dropping the weight onto a loading plate placed on the surface to be measured.
Please refer to the following book for more information on surveys and standards using Small FWD.
-"Design Standard for Railway Structures, etc., and its Commentary - Soil Structures," edited by Railway Technical Research Institute, 2007.
-FWD and Small FWD Operation Guide, Pavement Engineering Committee, Japan Society of Civil Engineers, 2002.
-Pavement Survey and Testing Handbook, Japan Road Association, 2006.
- "Interlocking Block Pavement Design and Construction Guidelines," Interlocking Block Pavement Technology Association, 2007.

System block diagram



3) Data confirmation

Data is automatically displayed and saved on the dedicated display unit, so check the values.



4) Move

Perform 2) and 3) a predetermined number of times, and after confirming rigidity, move to the next point.

Option

Additional weight (KFDF-11-10/15)
Change the mass of the weight to obtain the specified displacement according to the diameter of the loading plate. (for 10 kg, for 15 kg)

Loading plate (KFDF-31-90/150/200/300)
Select a loading plate with a diameter at least 3 times large than the maximum grain size of the geomaterial of interest (φ90, φ150, φ200, φ300)

Rubber buffer (KFDF-51)
Cushioning stopper for deadweight, consumable item as it changes over time.

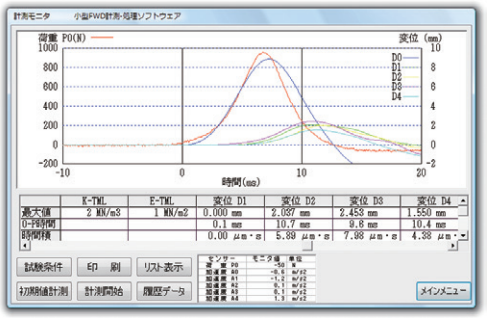
External displacement sensor (KFDS-1B)
Up to 4 displacement sensors can be connected for expansion.

Exclusive printer (DPU-S245)
Prints data recorded on a flash memory card

Carrier (KFDF-41)
This is a moving device dedicated to the small FWD main body, enabling more efficient multi-point measurement in a shorter time.

Calibration checker (KFDF-61)
Equipment for confirming measurement data on site.

Measurement software (TC-7100)
Controls a small FWD main body and external displacement sensor, calculates ground reaction force coefficient and deformation coefficient, displays results, waveform data display, and CSV conversion.



*RS-232C cable (CR-5360) is required separately
*FWD-Light is our registered trademark. Other company and product names are trademarks or registered trademarks of their respective companies

Calculation of coefficient of subgrade reaction : K_{TML}

$$K_{TML} = \frac{P}{\pi r^2 D} \times \frac{R}{R_{300}} \times 10^3$$

K_{TML} : Coefficient of subgrade reaction obtained by TMLSmall FWD system (MN/m³)
P : Load (N)
D : Displacement (m)
r : Radius of loading plate (m)
R : Diameter of loading plate R = 2r (m)
R_{300} : Diameter of standard loading plate (φ300mm)

Calculation of Modulus of subgrade elasticity: E_{TML}

Boussinesq Theoretical formula

$$E_{TML} = \frac{2(1-\nu^2)P}{\pi r D}$$

Burmister Theoretical formula

$$E_{TML} = \frac{(1-\nu^2)P}{2rD}$$

E_{TML} : Modulus of subgrade elasticity obtained by TML Small FWD system (MN/m²)
P : Load (N)
D : Displacement (m)
r : Radius of loading plate (m)
ν : Poisson's ratio (0.3, available to change)

The factory default setting is Boussinesq.

Specification

FWD-Light Main body (KFD-100A)	
Loading plate shape	φ100 × t15mm (KFDF-31-100)
Weight	5kg
Fall Height	50 ～ 530mm
Weight drop mechanism	Lever type (with stopper)
Sensor	
Load cell	Rated capacity 20kN
Maximum load	20kN
Accelerometer	Rated capacity 500m/s²
Max. displacement	2.500mm
Protection class	IP42 equivalent
Height	Approx. 1100mm
Weight	Approx. 1100mm
Exclusive Indicator (TC-351F)	
LCD	128 × 64 dots
Analysis Result Display	Maximum load value, maximum displacement, coefficient of ground reaction (K_{TML}), coefficient of deformation (E_{TML})
Data memory	Up to 7500 measurements
Memory card	CF card (max. 128 MB)
Recording format	CSV format
Interface	RS-232C
Power supply	Ni-MH Battery Pack
Continuous use time	Up to approx. 32 hours or 1000 measurements (at23 ± 5°C)
Dimensions	150 (W) x 120 (H) x 265 (D) mm (excluding protruding parts)
Drip-proof	IP-54 (with case lid in place)
Weight	3kg
Operating temperature range	- 10 to + 50°C, 85% RH or less (excluding condensation)

ISO 9001:2015 CERTIFICATION intertek UKAS MANAGEMENT SYSTEMS 014

Approval Certificate **ISO9001**
Design and manufacture of strain gauges, strain measuring equipment and transducers

The contents of this catalog are subject to change without prior notice.
The contents of this catalog are as of April 2025. TML Pam E0880F.

TML URL www.tml.jp/e

8-2, Minami-ohi 6-chome, Shinagawa-ku, Tokyo 140-8560, JAPAN
TEL: +81-3-3763-5614 FAX: +81-3-3763-6128