



Recoding Transportation and Mobility with AI and Automation





ROAD ASSET MANAGEMENT SOLUTIONS

(Category: Pavement Condition Monitoring with AI and IoT)

VTWAYS™ BACK24

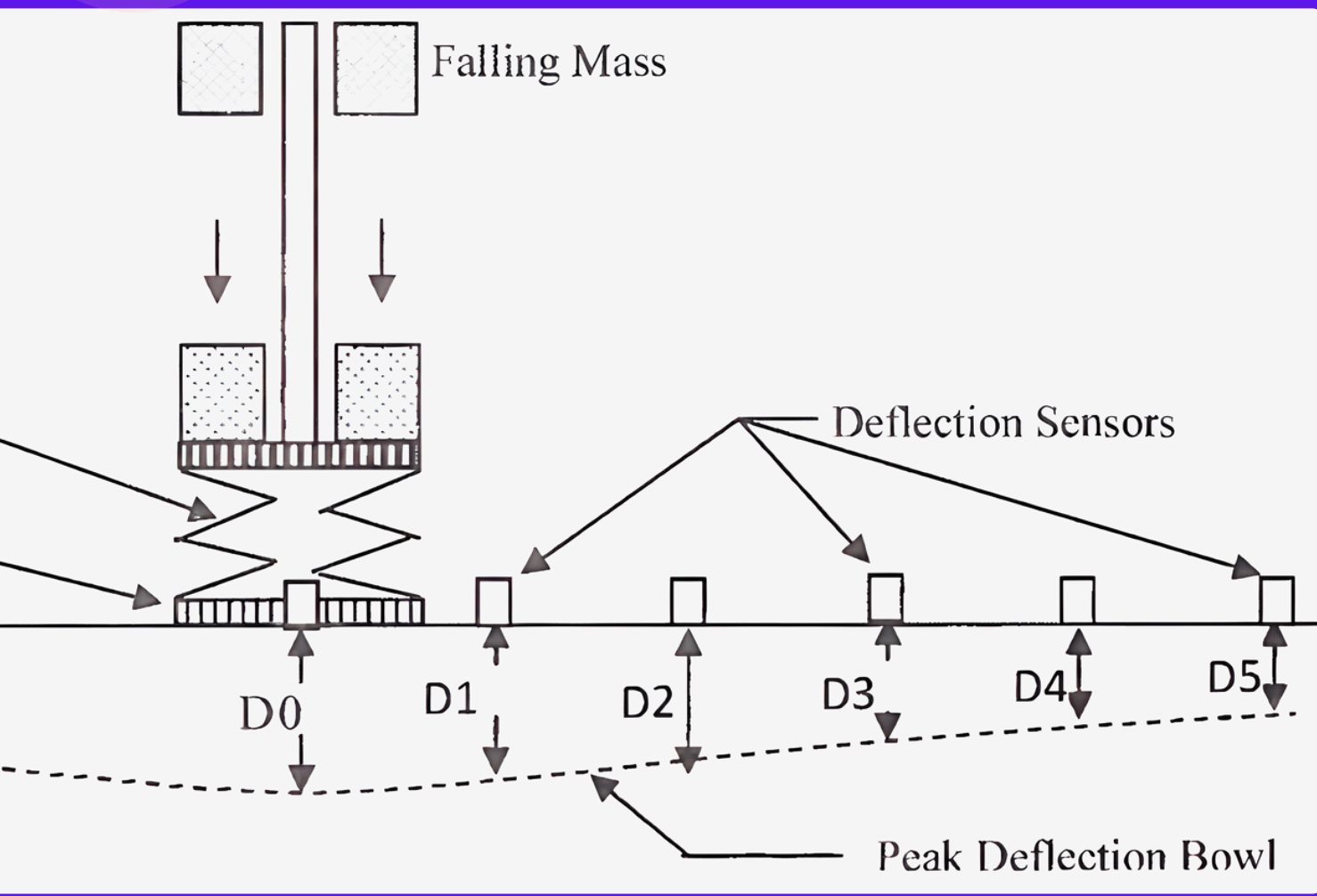
Automating FWD Data Analysis

TOPICS:

1. The Analysis of FWD data
2. VTWAYS™ BACK24
3. Demos



An Example of Analysis of FWD Data



```

TYPE PEAK FWD LOAD (N), CONTACT PRESSURE (MPa)
Standard Values are 40000 0.56
40000 0.56

HOW MANY DEFLECTIONS WERE MEASURED (4 TO 10)?
7

PRINT RAD.DISTANCES (mm) WHERE DEFLECT. WERE MEASURED
eg: 0, 300, 600, 900, 1200, 1500 is a Typical
Configuration for six Geophones

0 200 300 450 600 900 1500

PRINT MEASURED DEFLECTIONS IN mm.
0.1608 0.1233 0.1023 0.0735 0.0570 0.0353 0.0137
GIVE THE PAVEMENT RELATED INPUTS (3-LAYER SYSTEM)
TYPE EACH LAYER THICKNESS(mm). START FROM TOP
230 600 500

TYPE POISSON RATIO OF EACH LAYER. START FROM TOP
Suggested values are 0.5 0.4 0.4
0.5 0.4 0.4

INPUT RANGE (lower and upper) FOR EACH LAYER MODULUS
Please note that Backcalculation Results will depend
on the selection of appropriate Ranges. The slection
of Ranges has to be made judiciously on the basis of
of the Pavement Condition

PRINT LOWER AND UPPER BOUND MODULI (MPa) LAYERS
Pl. See the Manual supplied for guidance

750 3000
100 500
59 88
    
```

KGPBACK is an analytical tool to backcalculate the elastic properties of the existing pavement.

KGPBACK

1. Backcalculations of layer moduli.
 2. Temperature and seasonal corrections.
 3. Uniform subsections
 4. Fatigue in bituminous layer.
 5. Rutting in subgrade.
- More ...

Falling Weight Deflectometer Example

```

40000.00 0.56
7
0 200 300 450 600 900 1500
0.1608 0.1233 0.1023 0.0735 0.0570 0.0353 0.0137
230 600 500
0.5 0.4 0.4
750 3000
100 500
59 88
    
```



```
#####
# INPUT DATA #
#####
No.of Layers = 3
FWD Load (N) = 40000.00
Contact Pressure (MPa) = .56
No.of Deflection points = 7
Deflections measured using FWD (mm) = .16080 .12330 .10230 .07350 .05700 .03530 .01370
Radial distances from centre of load(mm) = .0 200.0 300.0 450.0 600.0 900.0 1500.0
Layer thickness (mm) = 230.00 600.00
Poisson ratio values = .50 .40 .40
Layer Modulus (MPa) Ranges Selected :-
(a) Bituminous Surfacing = 750.0 3000.0
(b) Granular Base = 100.0 500.0
(c) Subgrade = 59.0 88.0
```

```
#####
# OUTPUT DATA #
#####

Backcalculated Layer Moduli are:
Surface (MPa) = 2751.5
Base (MPa) = 494.1
Subgrade (MPa) = 88.0
```



- **Correction for Temperature**
 - Backcalculated moduli values of the bituminous layers.
- **Correction for Seasonal Variations**
 - Moisture content affects the strength of subgrade and granular subbase/base layers.
- **Computation of Design Traffic**
- **Overlay Design (Ref: IRC:37-2018)**
 - Fatigue in bituminous layer
 - Rutting in subgrade



PROCESS CHALLENGES THAT VTWAYS™ BACK24 ADDRESSES:

1. Handling large batches of FWD data is time-intensive and requires significant manual effort.
2. Eliminating the possibility of manual errors being introduced.
3. Providing an integrated platform for design calculations.
4. Data challenges such as validations, calculations etc.
5. Error reporting.
6. Use of modern computing infrastructure (Cloud and Edge).
7. Enabling data analysis at the VMFWD (Vehicle Mounted FWD).



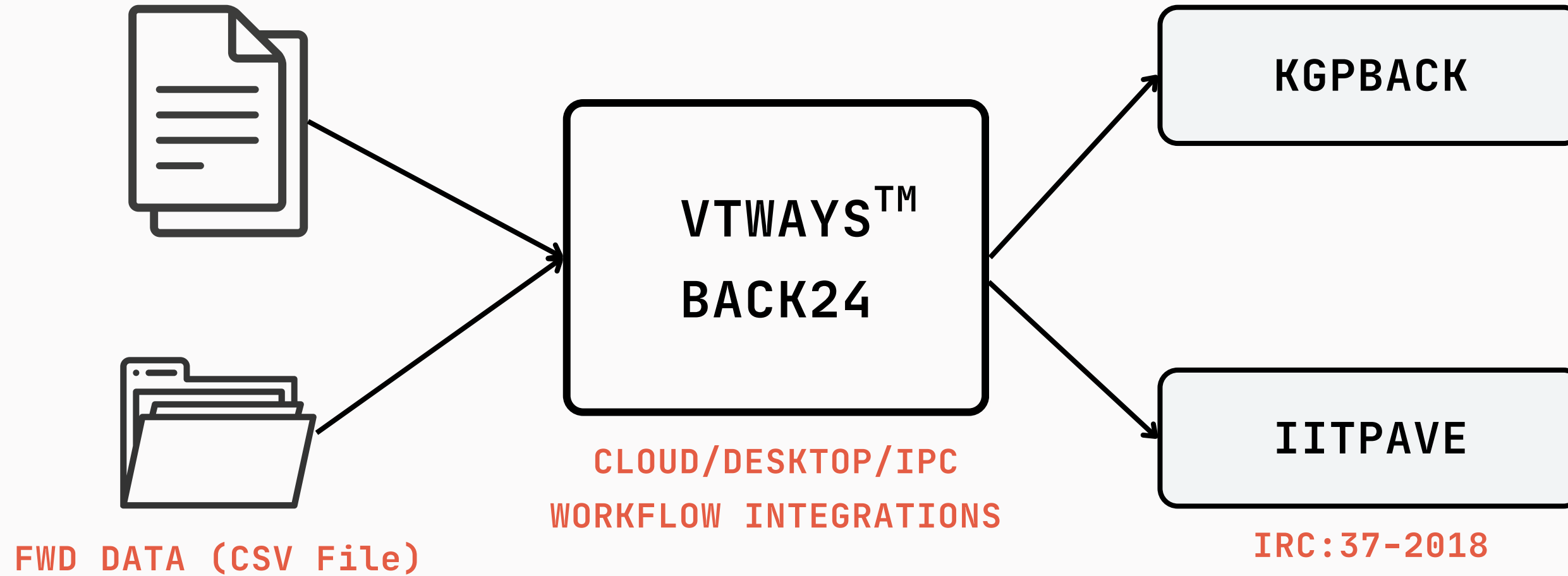
VTWAYS™ BACK24

Automating FWD Data Analysis

- Automates the processing of FWD data with KGPBACK thus enabling faster processing of FWD data for flexible pavements as per IRC:115-2014.
 - Computes temperature corrections for the Bituminous layer and seasonal corrections for Granular and Sub-base layers.
 - Data validation (deflections, drops, load etc.)
- Modern computing infrastructure and operating systems
 - Platform: Desktop PCs, Industrial PCs and Cloud.
 - Operating Systems: Windows and Linux.
- Vehicle mounted FWD
 - Ready to integrate with VMFWD equipment and pavement design workflows.
- Integrations
 - A flexible platform and frameworks for developing custom solutions including AI/ML for Road Asset Management.
- Eliminates manual effort considerably (more than 90%).



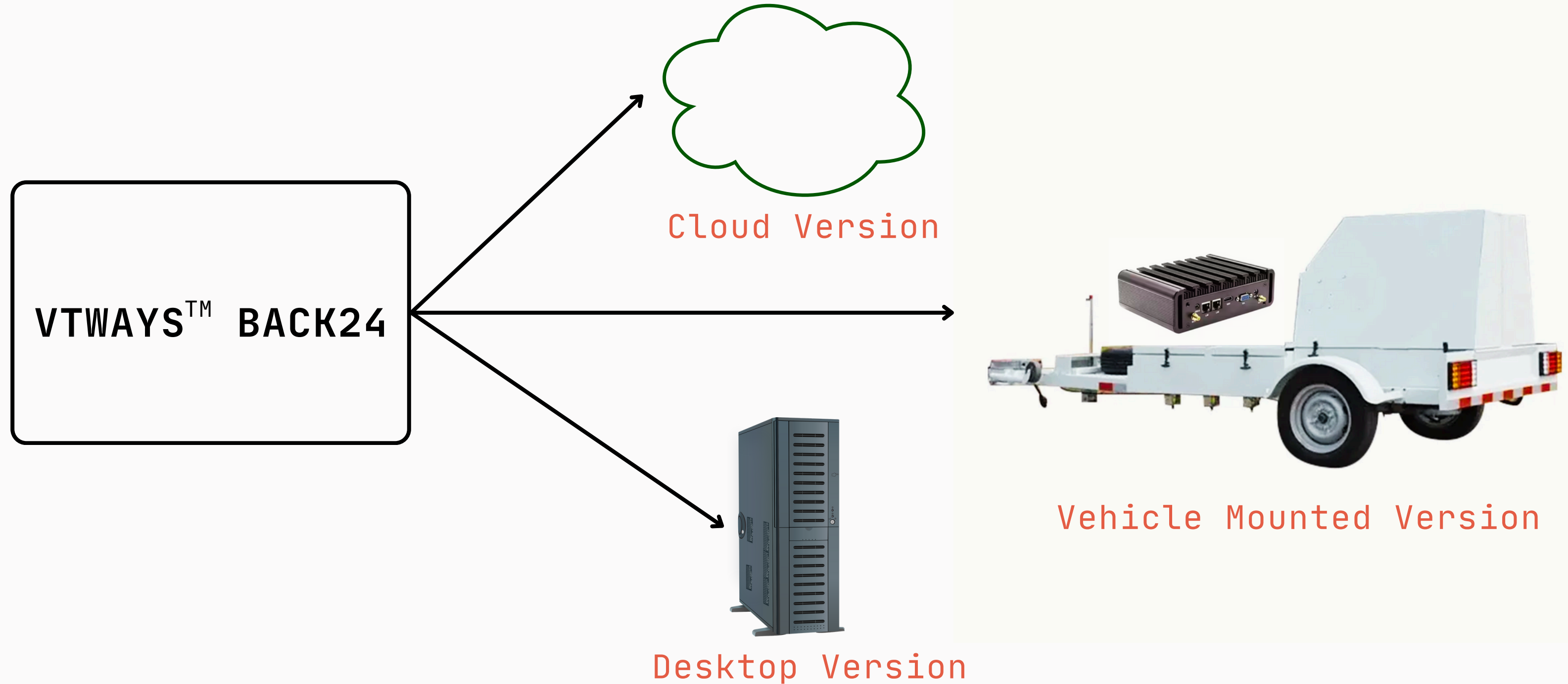
CONFIGURATION (JSON File)



- The purchase of IRC standards includes the KGPBACK and IITPAVE software CDs.
- We highly recommend joining the Indian Roads Congress (IRC) to procure essential software and standards like IRC:115-2014, IRC:37-2018, and more.
- Customers can acquire them by purchasing the specified standards from the IRC website or designated sales offices.

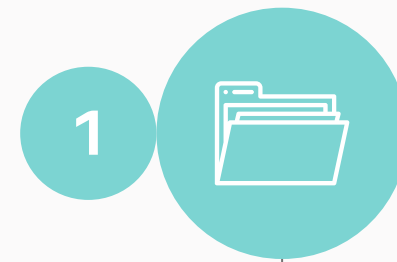


VTWAYS™ BACK24 SOFTWARE DEPLOYMENT OPTIONS



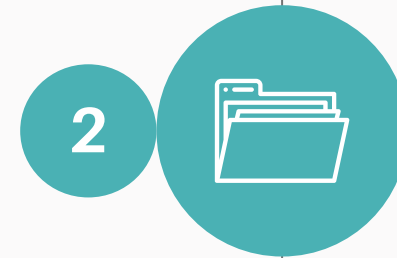
**VTWAYS™ BACK24**

SALIENT FEATURES /1



Batch Processing of FWD Data

Enables batch processing of FWD data using KGPBACK (IRC:115-2014) to determine layer moduli.



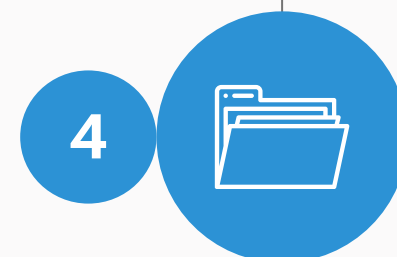
Temperature and Seasonal Corrections

Performs post processing on the layer moduli to determine temperature and seasonal corrections.



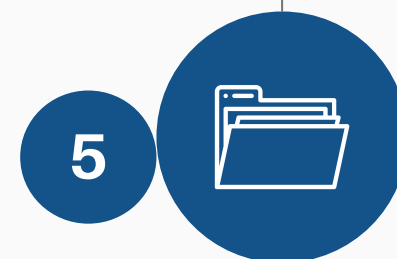
Automatic Handling of Drops

Performs Normalization to standard load (40kN) and average of the deflections. Handles drops automatically.



Supports 7 to 10 Geophones

Automates the backcalculation of FWD data, supporting configurations with 6 to 10 geophones.

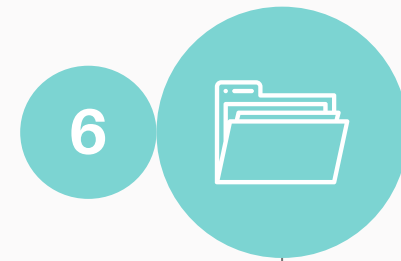


Software Deployment

Runs on Windows, Linux (Ubuntu), Industrial PC (at VMFWD), Cloud (AWS, Azure, Servers) and Intranet.

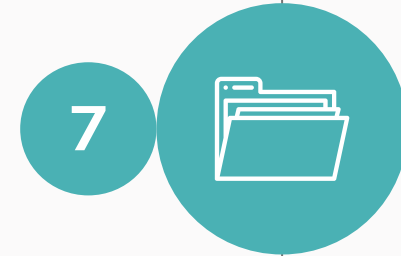


SALIENT FEATURES /2



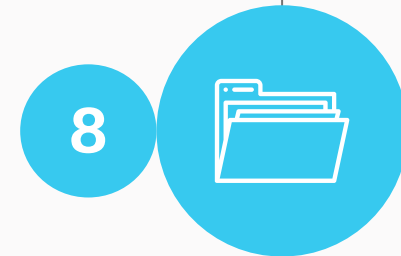
Managed Data Services

Upload the batch data to the web portal. We run the processing and provide the results back.



Vehicle Mounted FWD

Runs on commercially available industrial PC (Linux /Windows11) to perform data analysis at VMFWD.



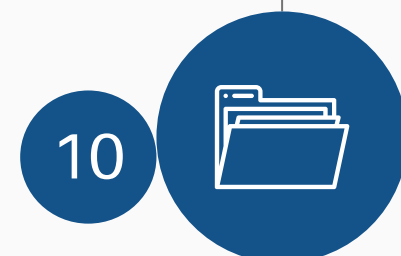
Customization and Workflow Integration

A flexible platform for designing custom solutions including AI/ML for Road Asset Management.



Software Pricing Plans.

Cloud / Desktop: Yearly or Monthly
VMFWD: Yearly (Hardware to be purchased separately)



Support and Training

Online training will be provided to the team. The software comes with regular updates and new features.



An Example of FWD Data Analysis

with

VTWAYS™ BACK24 (Desktop/Cloud/Edge @VMFWD)



Simple JSON-based
configuration



HEADER JSON

```
"date_created": "2024-08-18 12:27:55",
"project_name": "Your Project",
"project_location": "Your Project Location",
"performer_name": "Your Engineer",
"client_name": "Customer",
"location": "Location",
"district": "District",
"test_start_location": "Start Location",
"test_end_location": "End Location",
"contact_pressure_MPa": 0.56,
"deflection_sensor_numbers": [1, 2, 3, 4, 5, 6, 7], --> Example only
"deflection_sensor_locations": [0, 200, 300, 450, 600, 900, 1500],
"deflection_sensor_positions": ["Center", "Behind", "Behind", "Behind", "Behind", "Behind", "Behind"],
"bituminous_surfacing_poisson_ratio": 0.44,
"granular_base_poisson_ratio": 0.55,
"subgrade_poisson_ratio": 0.33,

"season": "Summer", --> Summer or Winter or Monsoon Only,
# FIXED Fields
"layers": 3,
"standard_load_N": 40000,
"load_unit": "kN",
"layer_thickness_unit": "mm",
"layer_modulus_unit": "MPa",
"deflection_unit": "micron",
"bituminous_modulus_E1_unit": "MPa",
"granular_modulus_E2_unit": "MPa",
"subgrade_modulus_E3_unit": "MPa",
```



FWD input data in CSV format.



FWD DATA (CSV File)

- # Serial Number 1 / Chainage 1+150 etc.
- (1) Samples,
- (2) Date,
- (3) Time,
- (4) Latitude,
- (5) Longitude,
- (6) Location,
- (7) Drop, --> Usually 1 ... 3
- (8) Load_kN,
- (9) D1_micron,
- (10) D2_micron,
- (11) D3_micron,
- (12) D4_micron,
- (13) D5_micron,
- (14) D6_micron,
- (15) D7_micron,
- (16) D8_micron,
- (17) D9_micron,
- (18) D10_micron,
- (19) Air_Temp._°C,
- (20) Surface_Temp._°C,
- (21) User_Comments,
- (22) Bituminous_Surfacing_Thickness_mm,
- (23) Granular_Base_Thickness_mm,
- (24) Subgrade_Thickness_mm,
- (25) Bituminous_Sur._Max._Modulus_MPa,
- (26) Bituminous_Sur._Min._Modulus_MPa,
- (27) Granular_Base_Max._Modulus_MPa,
- (28) Granular_Base_Min._Modulus_MPa,
- (29) Subgrade_Max._Modulus_MPa,
- (30) Subgrade_Min._Modulus_MPa

- (31) Bituminous_Modulus_E1_MPa
- (32) Granular_Modulus_E2_MPa
- (33) Subgrade_Modulus_E3_MPa
- (34) Bituminous_Modulus_E1_MPa_At_35_°C
- (35) Seasonal_Granular_Modulus_E2_MPa
- (36) Seasonal_Subgrade_Modulus_E3_MPa

OUTPUT (CSV File)

Output Error File



DEMOS

VTWAYS™

*Recoding Transportation and Mobility
with AI and Automation.*



THANK YOU

CONTACT

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FOR DEMO AND EVALUATION DEPLOYMENT