Grontmij | Carl Bro

We future-proof quality of life

6th European FWD user group meeting

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Topics to be covered

- FWD calibration in EU at present
- COST 336 Task 3
- SpecifiQ
- CROW FWD calibration procedure
- SHRP FWD calibration procedure
- TRL FWD Correlation Trial or FWD comparison day
- Today and the future
- Dilemma 1
- Dilemma 2 and 3
- Dilemma 4
- Dilemma 5
- Questions

FWD calibration in EU at present

- EU don ´ t have an official standard procedure for FWD calibration
- Each FWD manufacture use it's own calibration procedure.
- The NL CROW procedure (a part of) are used by some manufacture
- The US SHRP procedure are used by some manufacture
- The work done in the COST 336 task 3 group and SpecifiQ has never been “upgraded” to a EU official CEN standard.
- Some of the present standards dos not cover the number of geophones state-of-the-art FWD ´ s use today.
- TRL FWD Correlation Trial or FWD comparison day

COST 336 (task 3. FWD Calibration)

Officially started in 1996 COST Action 336 'Falling Weight Deflectometer'
Was a continuation of the Falling Weight Deflectometer Working Group of the Forum of Europea Highway Research Laboratories (FEHRL) that started in 1991.

The COST Action 336 comprises four tasks:

- **Task 1: Post-Processing of FWD Data**
- **Task 2: Applicability of FWDs at Network Level**
- **Task 3: FWD Calibration**
- **Task 4: Finalisation of Project Deliverables and Reporting**

The goal of this COST Action 336 is to develop a European common code of good practice for the use of Falling Weight Deflectometers in pavement evaluation.

This involves:
The establishing of common requirements for calibration of measurements and machines

The worked and funding stopped in 1999.

There was a one-year extension to the Action until June 2000

COST 336 task 3. FWD Calibration

A comprehensive set of FWD calibration procedures has been developed for increasing accuracy, repeatability, reproducibility and exchangeability of deflection data

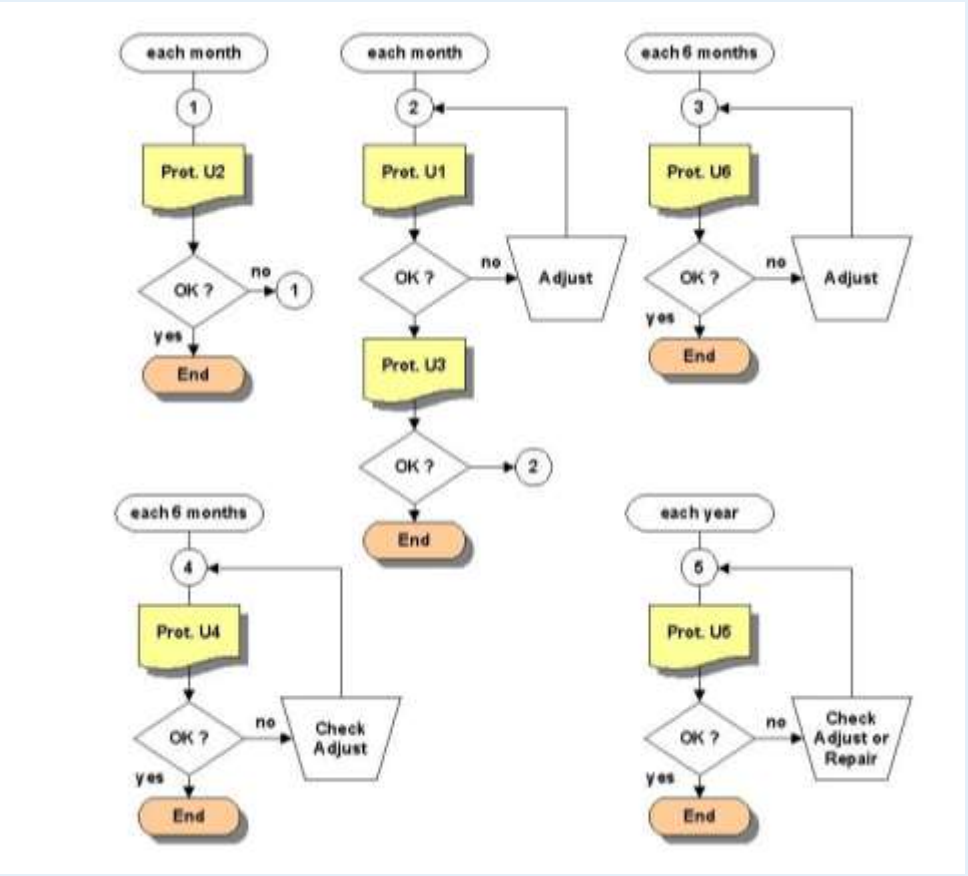
Approaches are provided to facilitate periodic check-up of a variety of calibration aspects at FWD User level

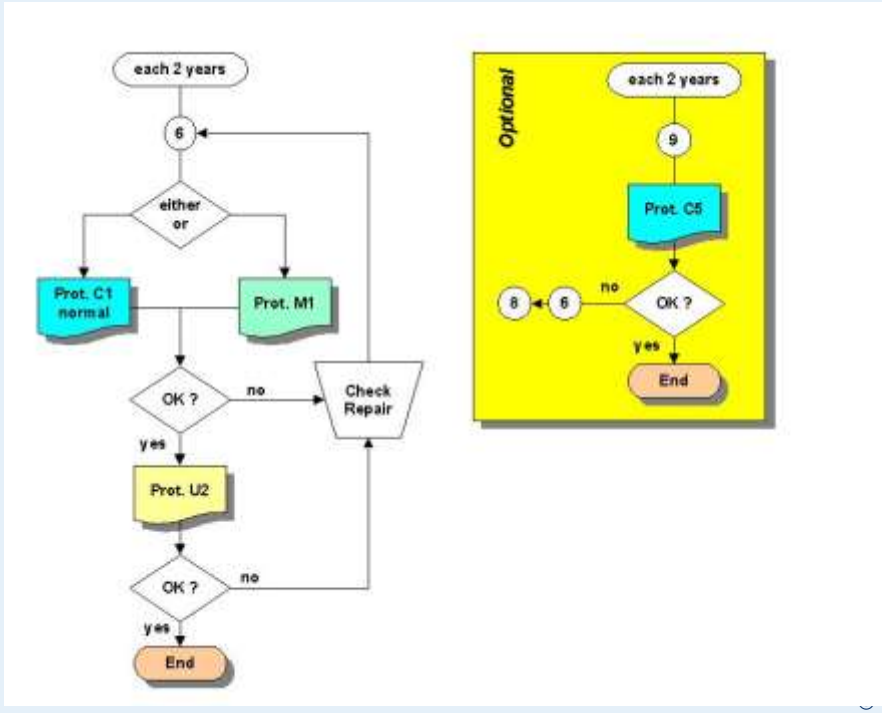
Guidelines are provided for the installation of a FWD calibration station.
The calibration protocols form excellent raw material for the set up for CEN standards for FWD calibration

This will improve the reliability and consistency of FWD results, which should enable more meaningful exchange of research results between countries.

COST 336 task 3. FWD Calibration

Calibration flow diagram





SpecifiQ

Complementary to COST 336 there was in 1999 also started a 2 year program called

SpecifiQ

= (Specifications for a Harmonised European Calibration Station for Improved Falling Weight Deflectometers Measurement of Road Quality)

One of the main goals for this program was A proposal for a CEN Standard for calibration of FWD ´ s

CROW FWD calibration procedure

C	=	FWD Calibration Station (appointed by CROW)
U	=	FWD User
M	=	FWD Manufacturer According to the protocol manufacture are allowed to make there own (non specified) procedure, but the FWD must still meet the following protocols

A-1998	(U)	Relative Calibration Verifications of FWD Deflection Sensors
B1-1998	(U)	FWD Short-term Repeatability Verification (single user)
B2-1998	(C)	FWD Short-term Repeatability Verification (at day of FWD Comparison)
C-1998	(U)	FWD Long-term Repeatability Verification
E-1998	(C)	FWD Deflection Sensor Calibration Verification
F-1998	(C)	FWD Group Field Calibration Procedure
G-1998	(C)	FWD Field Calibration Procedure
H1-1998	(C)	Reference Calibration of FWD Load Cell

CROW FWD calibration procedure

- With ref. to protocal F "FWD Group Field Calibration Procedure"

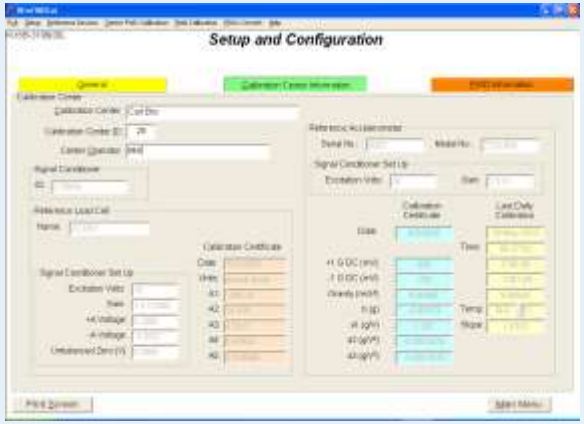
- Once every second year all FWD ´ s in EU are invited to a "FWD Group Field Calibration test day"
- The test are hosted by CROW
- Pass criteria are (in general) the mean of the measured data from participate FWD ´ s
- All FWD ´ s there pass the test will be issued with a new field calibration factor they can implement to there collected data in the next two year.

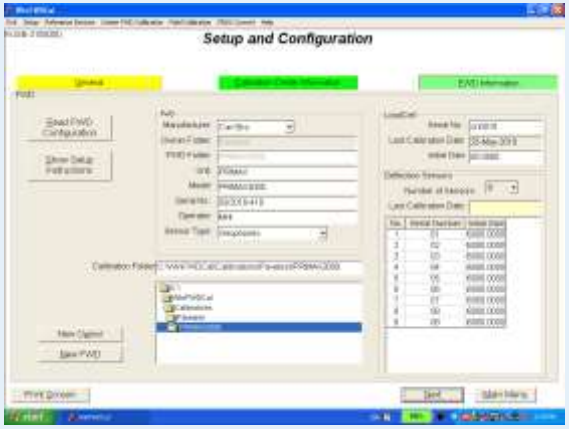
SHRP FWD Calibration

The SHRP calibration programme consists of 4 steps or “protocols”.

First Step/Protocol.

- **Entering all main FWD data – FWD operator- Test center information.**
- **Uploading all present FWD calibration parameters for all the FWD displacement transducers (geophone or LVDT)**





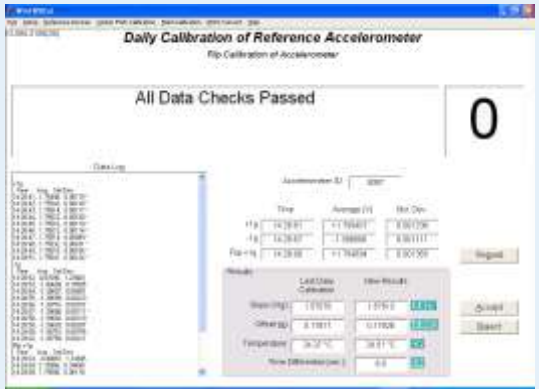
SHRP FWD Calibration

Second Step/Protocol.

- **Test and verification / Calibration of the Accelerometer there are used as reference for the FWD displacement transducers (geophone or LVDT)**

- **Determine the correct triggering level for the Accelerometer reference sensor.**

- **Determine the needed no. of drops and sequence for the SHRP test. (This will automatic be calculated by the system).**

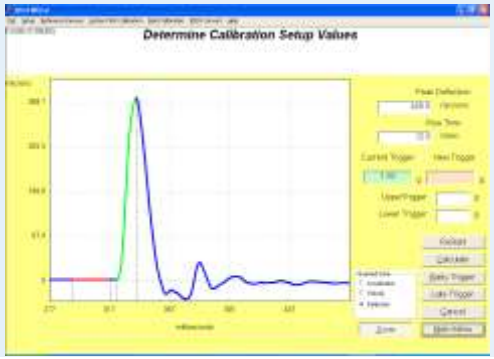


SHRP FWD Calibration

Third Step/Protocol.

- **Reference Calibration of the FWD displacement transducers (Geophone or LVDT) with the Accelerometer as reference**

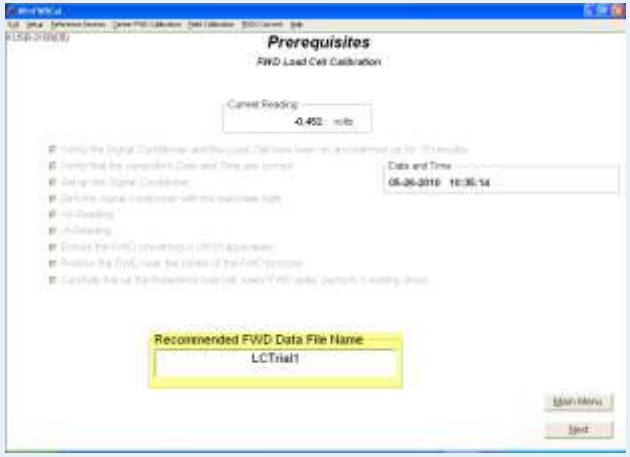
- **Additional a Relative calibration (stacking tower) witch end up with the final gain or calibration factor**

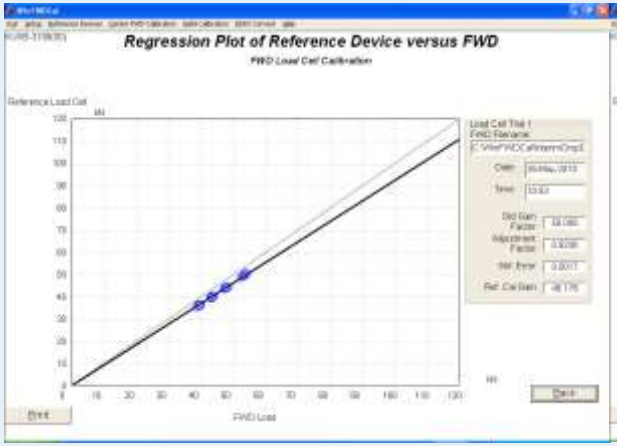


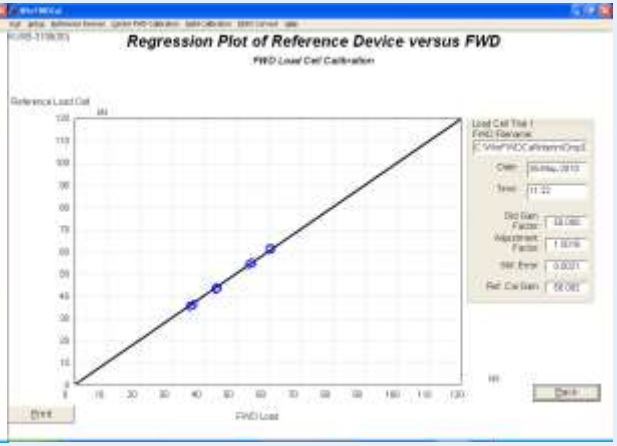
SHRP FWD Calibration

Fourth Step/Protocol.

- **Reference Calibration of the FWD Loadcell, with the SHRP loadcell as reference**







Advantage with the SHRP prcedure

- The system is portable and can be transported as standard flight luggage.
- The SHRP calibration system and procedure can handle and calibrate all brands and types of FWD.
- FWD customers are no longer linked to a specific manufacture and/or calibration test center
- Free market and lower total calibration cost…. Hopefully ☺

SHRP Test center in Europa

- **Grontmij Carl Bro decided to implement the SHRP calibration procedure parallel to our own manufacture calibration procedure**

- **Grontmij Carl Bro are the only certified SHRP calibration in Europe at present.**
- **Grontmij Carl Bro has been certified SHRP calibration center since 2007.**

Grontmij | Carl Bro
FWD Calibration Center
2007-2008 Certification

This will certify that the Grontmij | Carl Bro FWD Calibration Center has been certified as per the FHWA FWD Calibration Protocol, Appendix F, April 2007. This certification is good until 30 September 2008.

Equipment:
MicroMeasurements Model 2310 signal conditioner S/N: 175608
Keithley KUSB DAQ board S/N: 1142332
Reference Load Cell S/N: GCB01
Silicon Designs ± 5g Accelerometer S/N: 9087

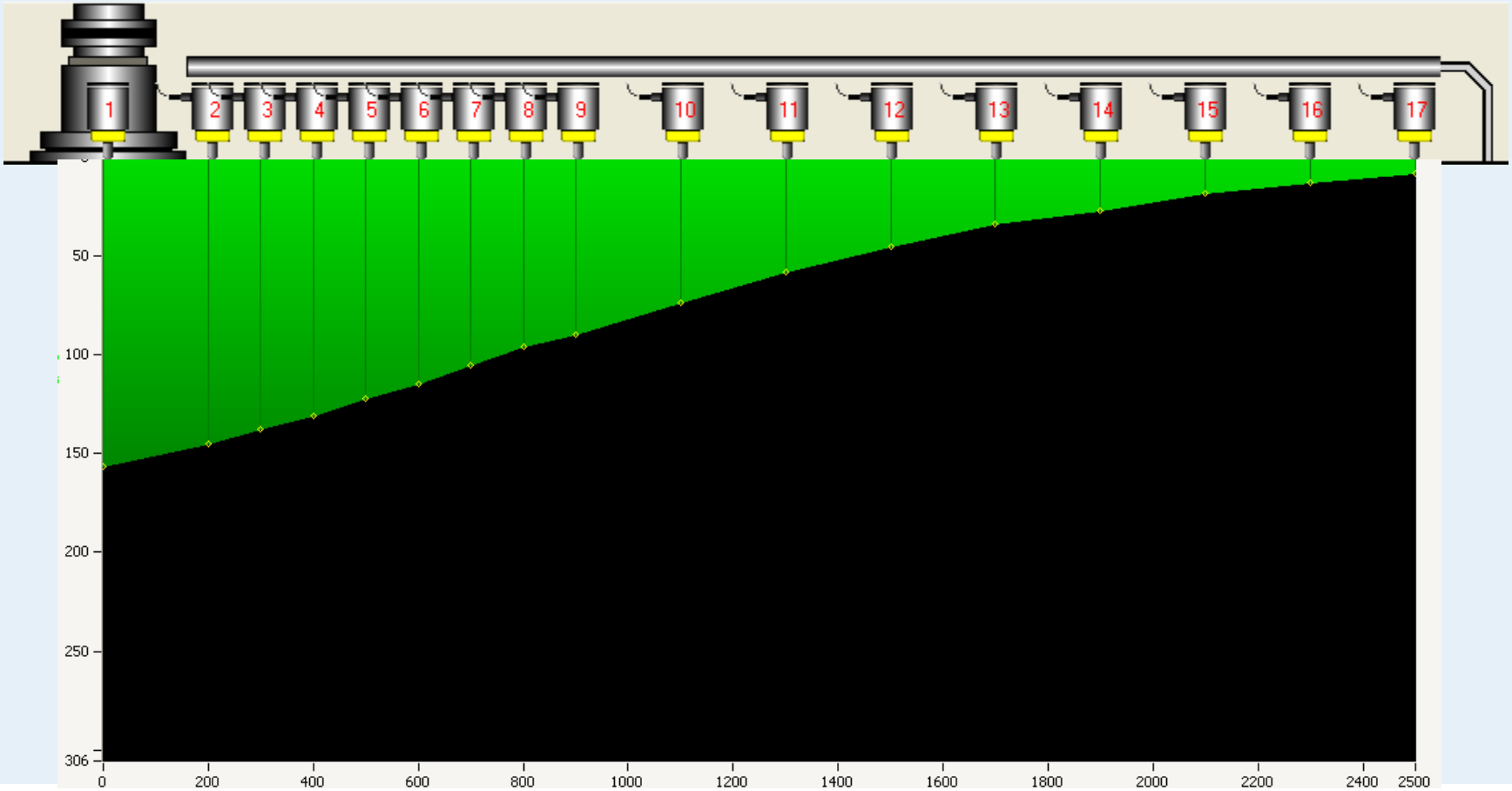
Certified by: _____ Date: 30 September 2007

TRL verification (calibration) test day

- Once a year all FWD ´ s in UK must pass a FWD Group Field Calibration/verification test.
- The test are hosted by TRL on behalf of Highway Agency in UK
- Other FWD ´ s from other countries are also allowed to participate
- Pass criteria are the mean of the measured data from participating FWD ´ s on the day
- FWD there don't pass the test are not allowed to measured for Highway Agency in UK

Today and the future

- **In order to improve the analysing of measurements, today's FWD often has up to 18 geophones**



Today and the future