



MEASUREMENT
OF VERTICAL FORCES
ON WHEELS AND
WHEELSETS:
**FINALLY EASY, FAST,
ANYTIME & EVERYWHERE!**

CERTIFIED BY



EN 15654-2:2019 & EN 50215:2011
COMPLIANT



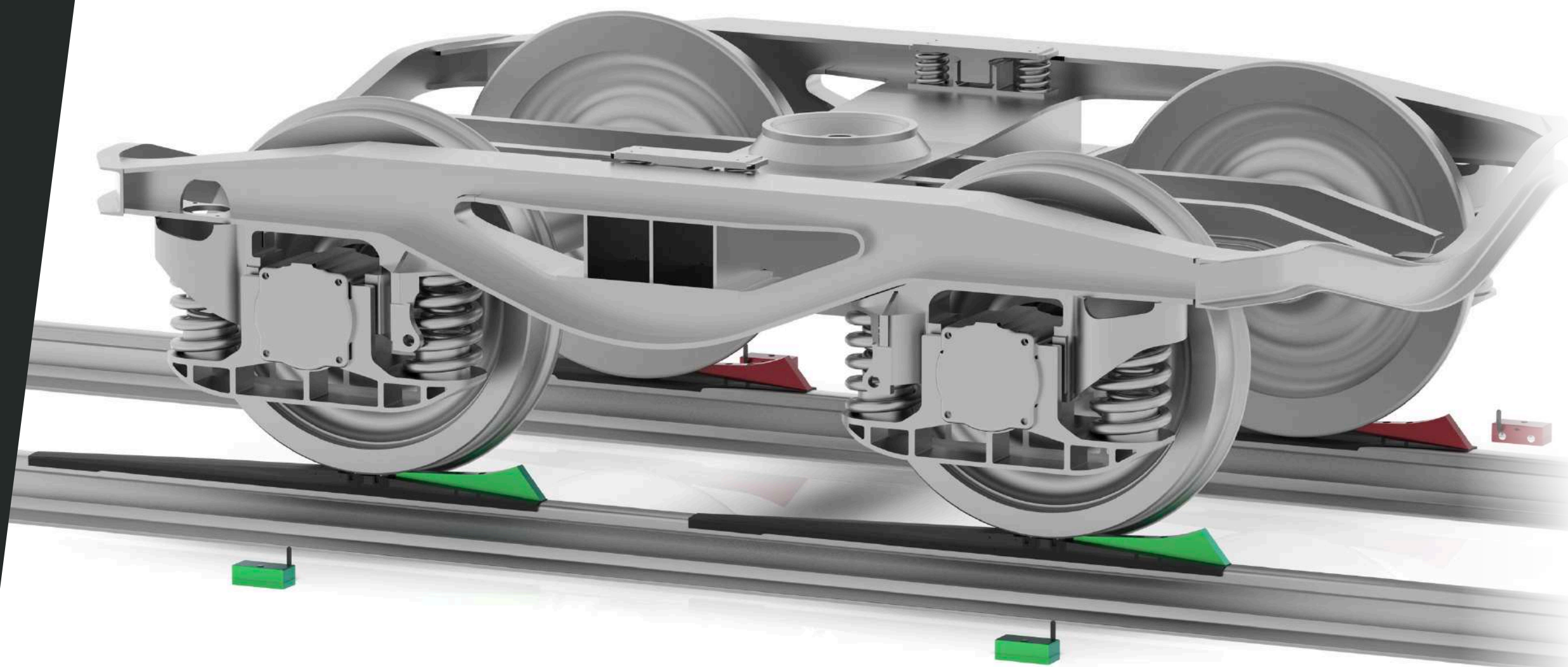
POWERVE®

portable **w**eigher for **r**ailway **v**ehicles

The right distribution of the vertical forces on each wheel is a key-factor to ensure the dynamic stability of any rolling stock and avoid abnormal wear in wheel/rail interaction. Unloaded wheels, especially on the diagonal side of a bogie, can significantly decrease the capacity of the bogie to safely run on twisted tracks, increasing derailment risk.

Abnormal wheel wear and/or faulty suspensions can lead to unloaded wheels, even during the interval between two successive extraordinary maintenance cycles of bogies.

More and more frequently the maintenance technician feels the need to check the distribution of the vertical forces on each wheel.



How to increase the monitoring frequency?

It is usually needed a high performance fixed weighing system, capable of performing measurements with huge precision and accuracy, directly at the wheel/rail interface and in stable equilibrium conditions during the process.

Unfortunately the right fixed system is not always easy to find nearby. Furthermore moving a rolling stock vehicle to a fixed weighing system, often located far away, can be expensive too.

As a result, increasing the monitoring frequency of static vertical forces on each wheel, is an expensive and challenging achievement.

How to turn it into a sustainable & optimized solution?

IVM is glad to introduce POWERVE®, the most innovative static wheel force measuring system. The impressive performances that the system has achieved are comparable to high-accuracy fixed weighing systems but it is an easy and hand-portable one.

POWERVE® can increase the frequency of monitoring in a sustainable way, allowing you to enable maintenance approaches, no longer periodic, but on-condition and predictive.

Finally a quick and easy equipment, anytime & everywhere.

POWERVE® IS THE IDEAL SOLUTION FOR

- Testing & Commissioning of new, maintained or modified rolling stock, compliant with the EN 15654-2 and EN 50215
- Workshop or in-field maintenance
- Suspension load adjustment to equalize vertical forces on wheels (leveling)
- Reducing derailments risk, especially on twisted track and at low speed
- Verifying the distribution of traction on driving wheels
- Verifying the distribution after installation of new equipment on the rolling stocks
- Verifying the distribution of the vertical forces due to non-uniform wear of the wheel diameters or faulty suspensions
- Verifying load distribution on cargo railcars
- Post derailment investigations
- Calibration and on-site verification of dynamic weighing systems compliant with the EN 15654-1, according to EN 15654-3

AWARDED BY



H2020 SME
INSTRUMENT



RAILWAY INNOVATION
LEADER 2019



INNOVATION
AWARD 2019



5TH DIGITAL
AWARDS 2020



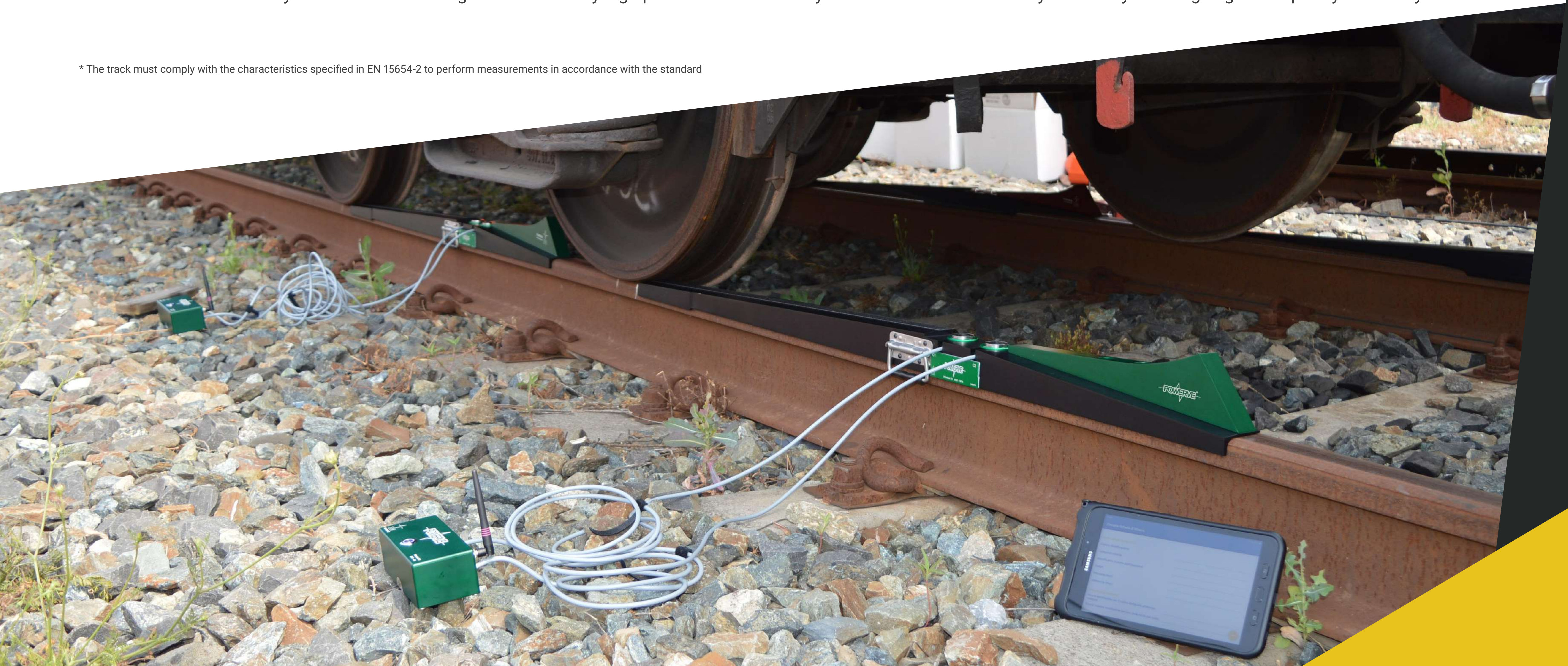
IMPRESSIVE PERFORMANCES

POWERVE® has been continually improved over the years, achieving impressive performances that are comparable with highly accurate static fixed weighing systems. **POWERVE®** is a measuring instrument certified by ITALCERTIFER (ref. Assessment report ITCFC-19222-11-ATF-RA-00011), in compliance with the following standards:

- EN 15654-2:2019 “Railway applications – Measurement of vertical forces on wheels and wheelsets – Part 2: Test in workshop for new, modified and maintained vehicles”.
- EN 50215:2011 (only for the parts relating to rolling stock weighing and vertical load produced by each wheel on the track)

POWERVE® transforms any rail * into a measuring station with very high precision and accuracy characteristics that allows you to carry out weighing tasks quickly and easily.

* The track must comply with the characteristics specified in EN 15654-2 to perform measurements in accordance with the standard



SAFETY EQUIPMENT

More than just a weighing equipment, POWERVE® can be considered an equipment for the railway industry to increase running dynamics, being able to instantly measure the rolling stock's vertical wheel force distribution, detecting potential unbalancing issue.

Front view



WHEEL/RAIL INTERFACE

One of the most interesting system feature is its ability to directly measure the wheel force distribution on each wheel Q_{F0} . In fact, it is the unique portable system able to perform the measurements at the wheel/rail interface.

Rear view



LOCATION OF CONTACT POINTS

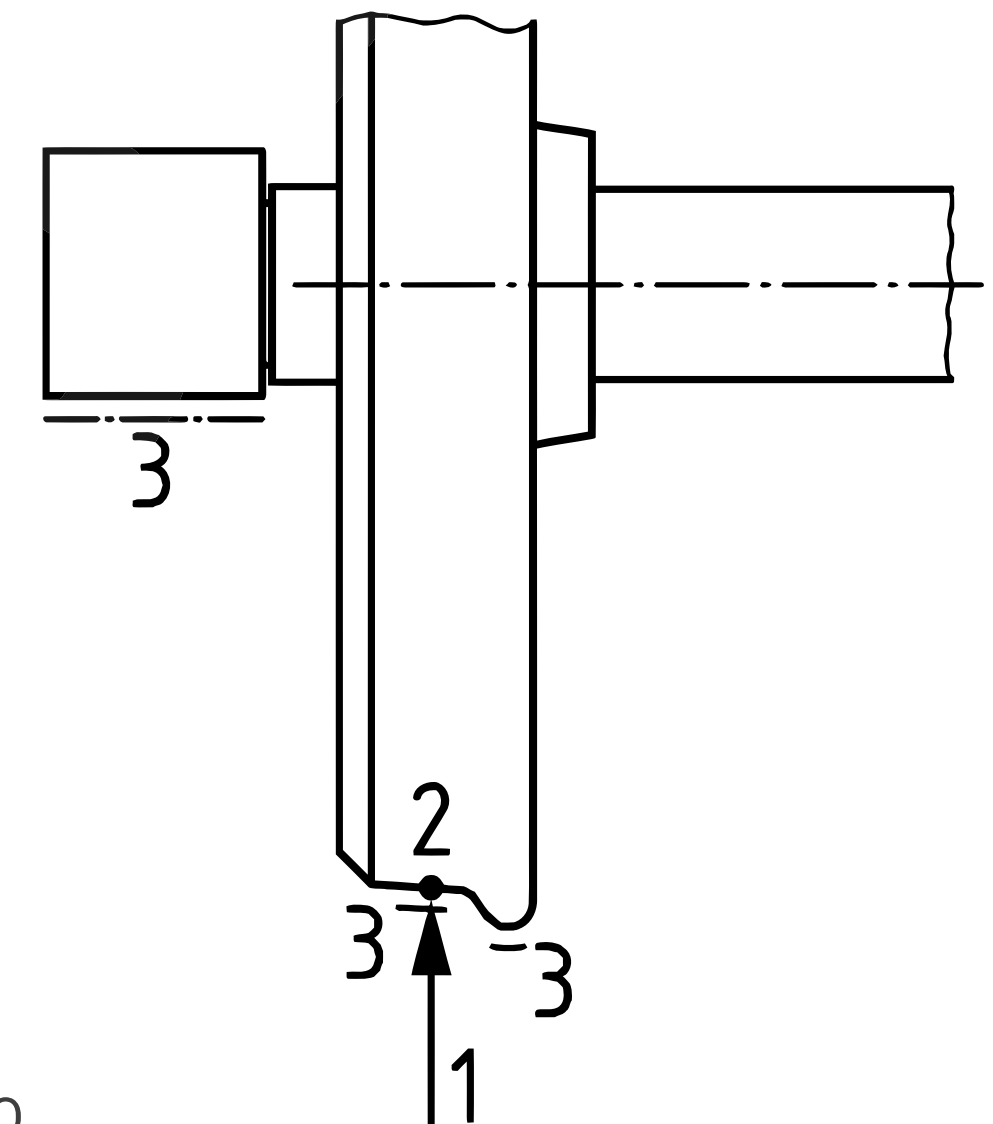
(Running surface, flange top, axle boxes)

As specified in EN 15654-2:2019 at the paragraph 4.2.3.2: “the contact points between the vehicle wheels and the measurement devices are usually on the wheel tread profiles at/or near to the reference points. Other contact points on the wheel flange or on the axle box can be used. In these cases, Q_{F0} (the vertical wheel forces at the reference points) shall be calculated from the measured values taking into account the difference between the location of the contact point and the reference point”.

POWERVE® performs measurements directly near to the reference points. It directly determines the Q_{F0} , without any additional and complex calculations, contrary to the measurements on the wheel flange or on the axle box.

MEASUREMENT PERFORMED DIRECTLY AT WHEEL TYRE

No additional calculations required!



Key

1. vertical wheel force Q_{F0}
2. reference point D_0
3. possible locations of contact point (running surface, flange, axle box) for measurement device



UNIQUE “CRADLE” DESIGN

The unique “cradle” design of the measuring area, made of two load cells for each wheel, let the rolling stock stay on the measuring zone in self equilibrium condition.

For this reason, there is no need to involve external forces to stop the rolling stock on the system, avoiding possible errors due to braking/ traction forces.

The system measures the vertical forces that each wheel loads on the track, at the wheel/rail interface and in working order conditions, without modifying the natural status of the suspensions.

MODULAR & SCALABLE

The POWERVE® system is extremely modular and scalable because it measures from 2 to 6 wheelsets at the same time, depending on the measuring necessities. It is constituted by 2 main functional Kits:

Wheelset Kit

Control System

The Wheelset Kit includes the mechanical parts and the sensing elements with the dedicated acquisition boards, needed to measure each single wheelset.

The Control System includes the execution and control elements, needed to manage the measuring process. The Control System allows to control any Wheelset Kit, without configurations needed. Moreover it also includes a Cloud platform, to manage and download all the measures in the most common formats (PDF, Excel, CSV).

The commercial configurations of the POWERVE system are:

POW2X made of 2 Wheelset Kits (each one measures the vertical forces of each wheel of a wheelset at the same time), and 1 Control System.

POW3X made of 3 Wheelset Kits and 1 Control System.

POW4X made of 4 Wheelset Kits and 1 Control System.

POW6X made of 6 Wheelset Kits and 1 Control System.



The POW2X version allows to measure the following wheelsets arrangement, (regardless of whether the wheelsets are driving or trailing):

A (1 single wheelset, in case of trailers) – in 1 measurement session;

A-A (2 single wheelsets) – in 1 measurement session;

B-B (2 bogies made of 2 wheelsets each) - in 2 measurement sessions;

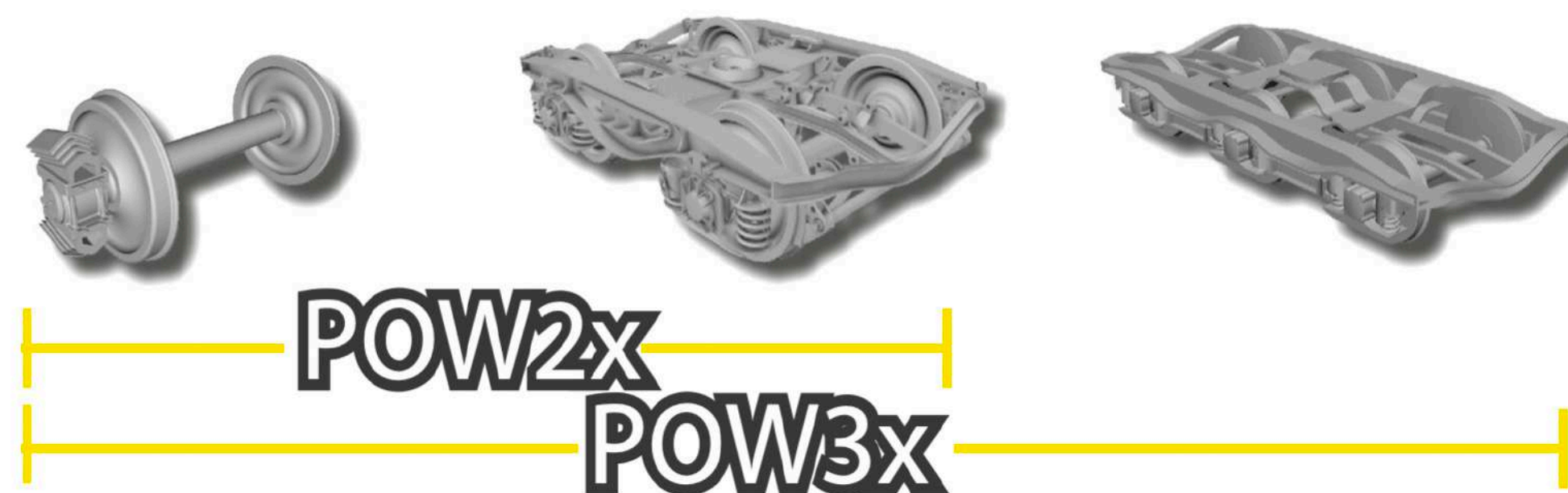
B-B-B (2 frames separated by a coupler, on 3 bogies made of 2 wheelsets each) - in 3 measurement sessions;

The **POW3X** version allows to measure in addition to the POW2X version, also the following rolling stock type:

A1A or C (3 wheelsets in total) – in 1 measurement session;

C-C (2 bogies made of 3 wheelsets each) - in 2 measurement sessions;

The versions **POW4X-POW6X** have been developed to allow the measurement of the whole vehicle body in 1 measurement session, up to 6 wheelsets at the same time.



TRACK GAUGE INDEPENDENT

The system is gauge independent. The ramps can be installed also on the multiple gauges tracks, without limitations

THE ROLLING STOCK RISES EASILY

The rolling stock to be measured can be easily moved on the ramps by using a shunting vehicle (electric or diesel), a locomotive or just by using a couple of winches.

Minimum slope of the ramps: 42,3‰



IS YOUR TRACK LENGTH LIMITED?

No problems!

The measurement procedure requires moving the rolling stock by just 1 meter during the operation as opposed to fixed systems which require at least twice the train length.

So, it is perfect also for small workshops where the length of leveled tracks is limited.

IT FITS ANY RAIL PROFILE

It can be easily installed on different ranges of rail profiles. Customized rail profiles ranges might be available under request.



THE LIGHTEST RAILWAY WEIGHING SYSTEM EVER!

Hand-transportable everywhere,
also by airplane (about 25 kg for
each Wheelset Kit split in 2 cases)
Heaviest single part of just 6,3 kg



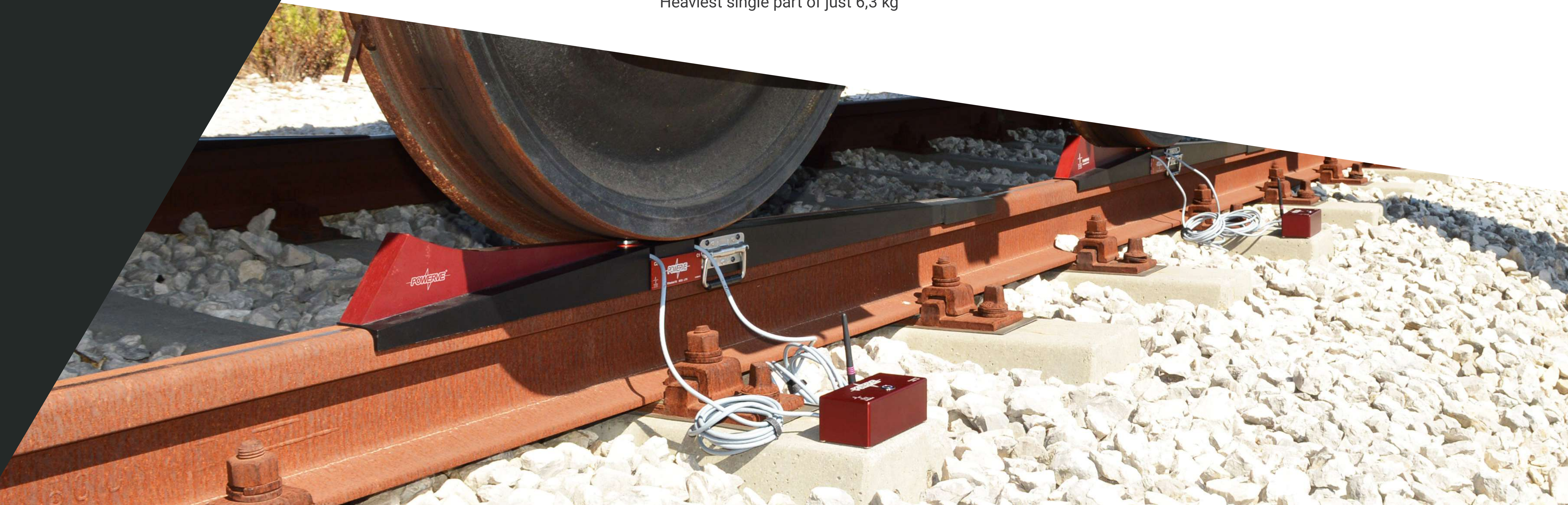
WIRELESS CONNECTION

Each Wheelset Kit connects via
wireless technology. This allows
for easy installation and simple
operation.



TIME SAVING

The operation is very efficient and
time saving! The installation of the
ramps and the sensing elements
takes just a few seconds, without
any mechanical fixing!



USER FRIENDLY SOFTWARE

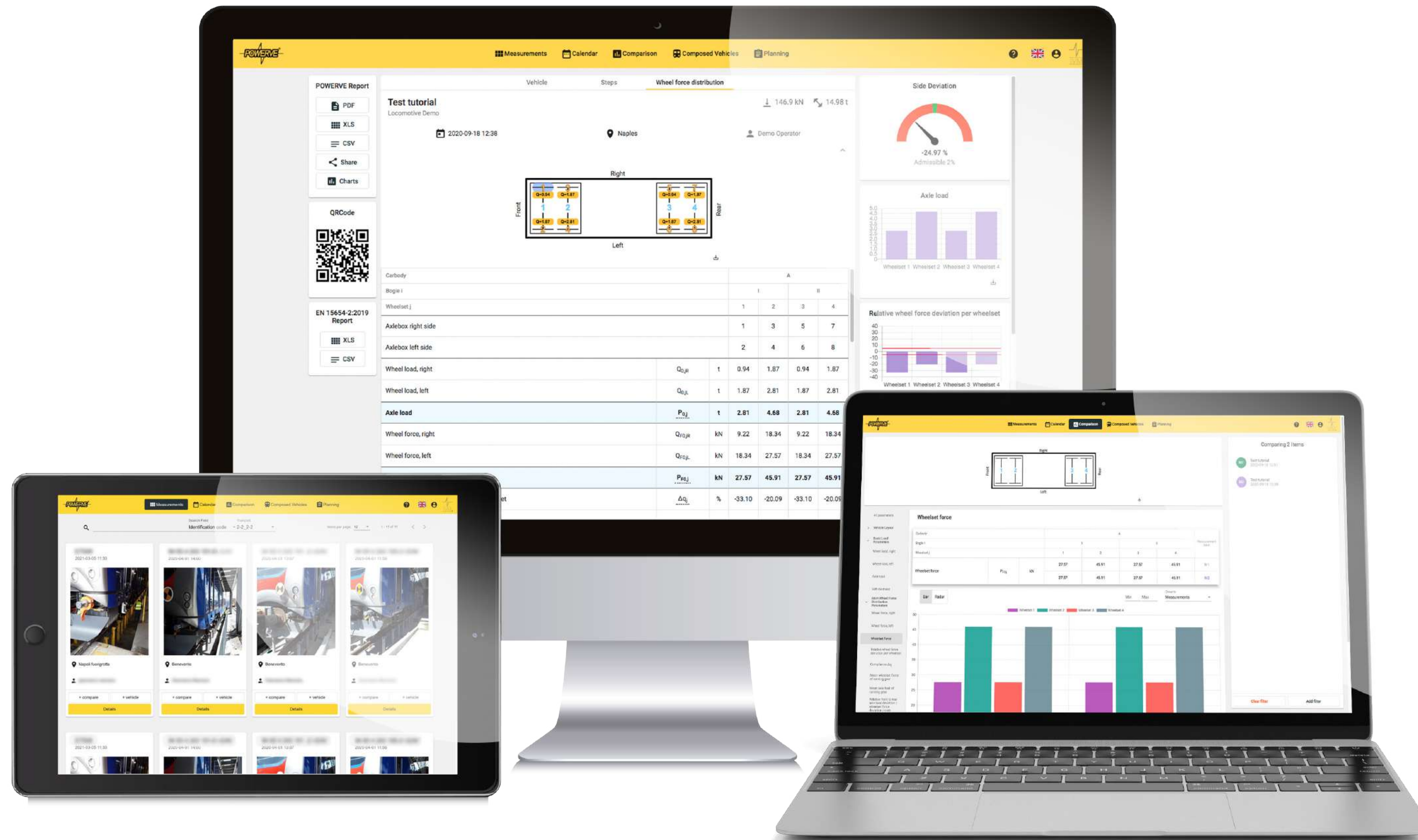
POWERVE® is supplied with the POWERVE® Control System software, an Android app directly installed on the tablet.

The Control System is a full software package, very user-friendly, designed to support the operator and to guide him during the whole measurement cycle.

HUMAN INDEPENDENT RESULTS

POWERVE® is equipped with several checks and visualization systems to control the measurement, (Auto-Quality Checks, including AutoDiagnostics), also aimed to limiting human errors.





SMART CLOUD PLATFORM

The POWERVE Control System was not only designed just for easy data collection in the field.

The system is fully digitalized and it is equipped with a dedicated Smart Cloud Platform, where the operator can easily manage and compare the measurements over the time.

ALSO TESTED IN OPERATING CONDITIONS

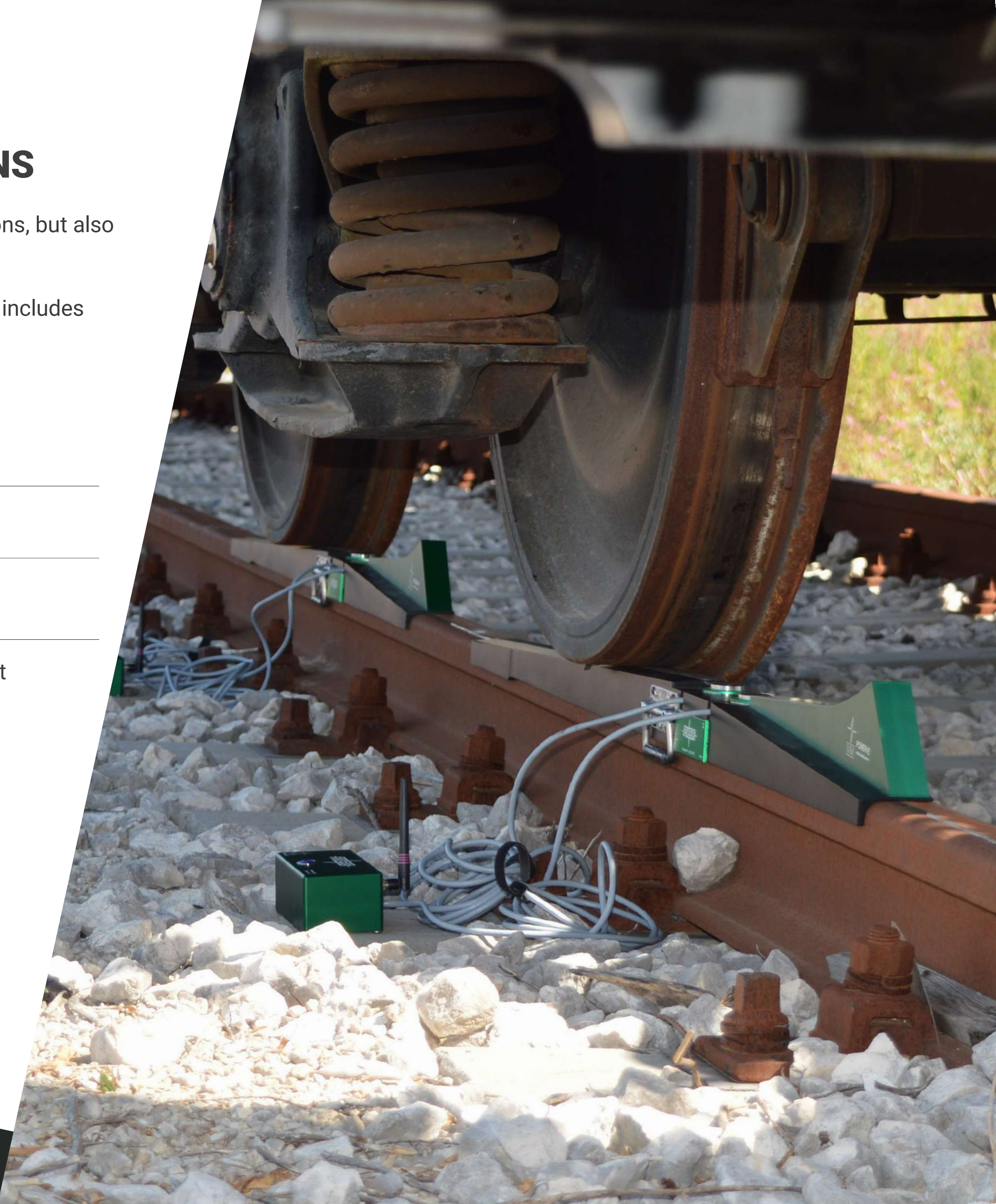
The system accuracy was determined not only under laboratory conditions, but also under field operating conditions.

The accuracy of the sensing elements, that was tested in the laboratory, includes the following values:

Capacity	15 tons/wheel - 30 tons/wheelset
Maximum Safe Load (lim)	30 tons/wheel
Class of the cell (sensor)	Class 1 according to the UNI EN ISO 376:2011 Accuracy < 0,1%
Class of the pair	Class 0.5 as per ISO 7500-1 according to the Test Procedure specified in the EN 15654-2:2019

The accuracy of the whole system that was tested in the field and in operating conditions is:

0,5% ON THE TOTAL WEIGHT



CALIBRATION PERIOD: DISCOVER THE COURTESY KITS

The calibration period or any system fault always determines the unavailability of the system and impacts on the customer's activities and his productivity.

In order to fully support the customer and to guarantee a full availability of the system even during the calibration period/faults, a temporary Courtesy Kit is provided to the customer before to ship the system to be calibrated.

The Courtesy Kit replaces only the parts to be calibrated (Acquisition Boards and the related Load Cells). It consists of the same quantity of Wheelset Kits to be calibrated/ fixed in order to fully cover the measuring necessities.





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