

**ISWIM**  
International Society for Weigh in Motion



## WIM for Direct Enforcement in Europe

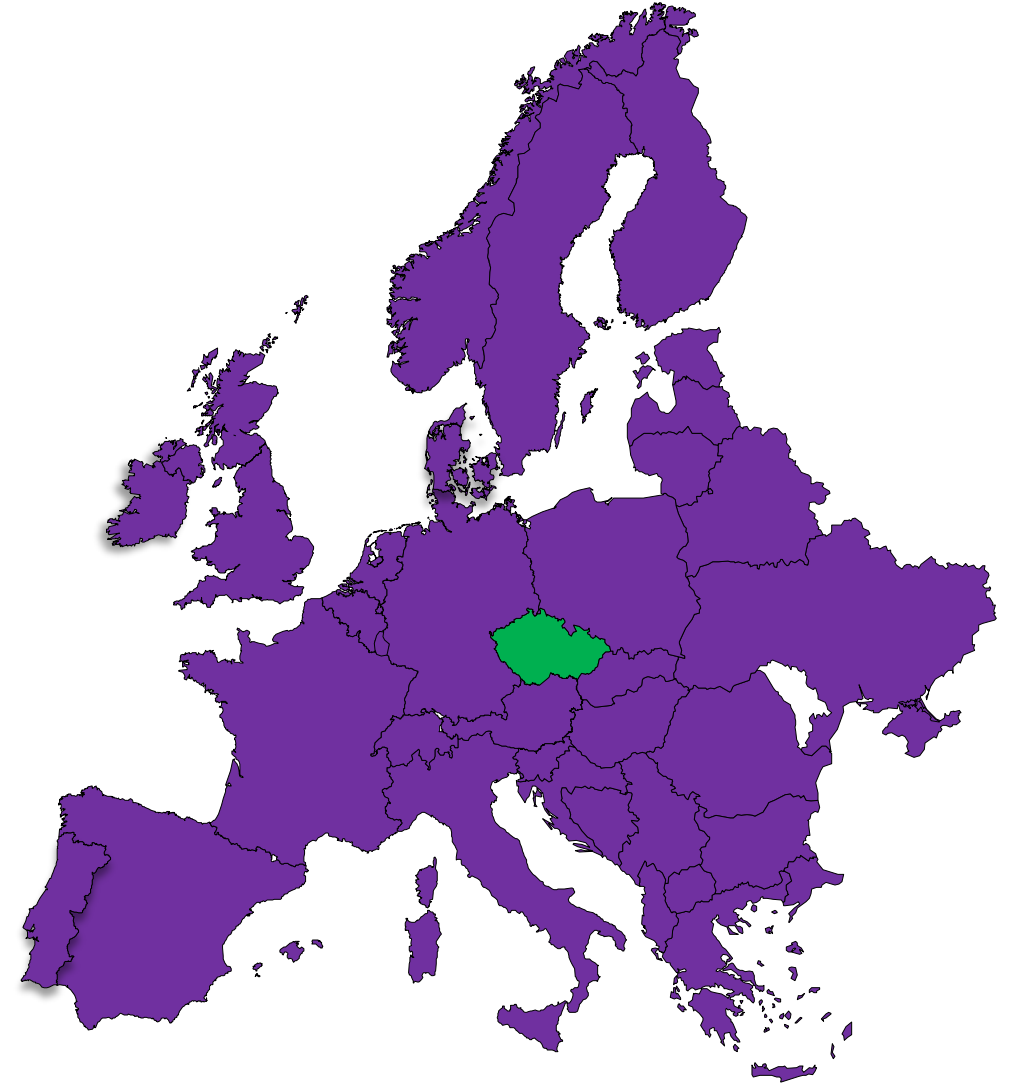
Eugene OBrien, *University College Dublin & RDS*, Ireland  
Bernard Jacob, *University Gustave Eiffel*, France

SATC/ISWIM Workshop on WIM for Direct Enforcement  
July 2025



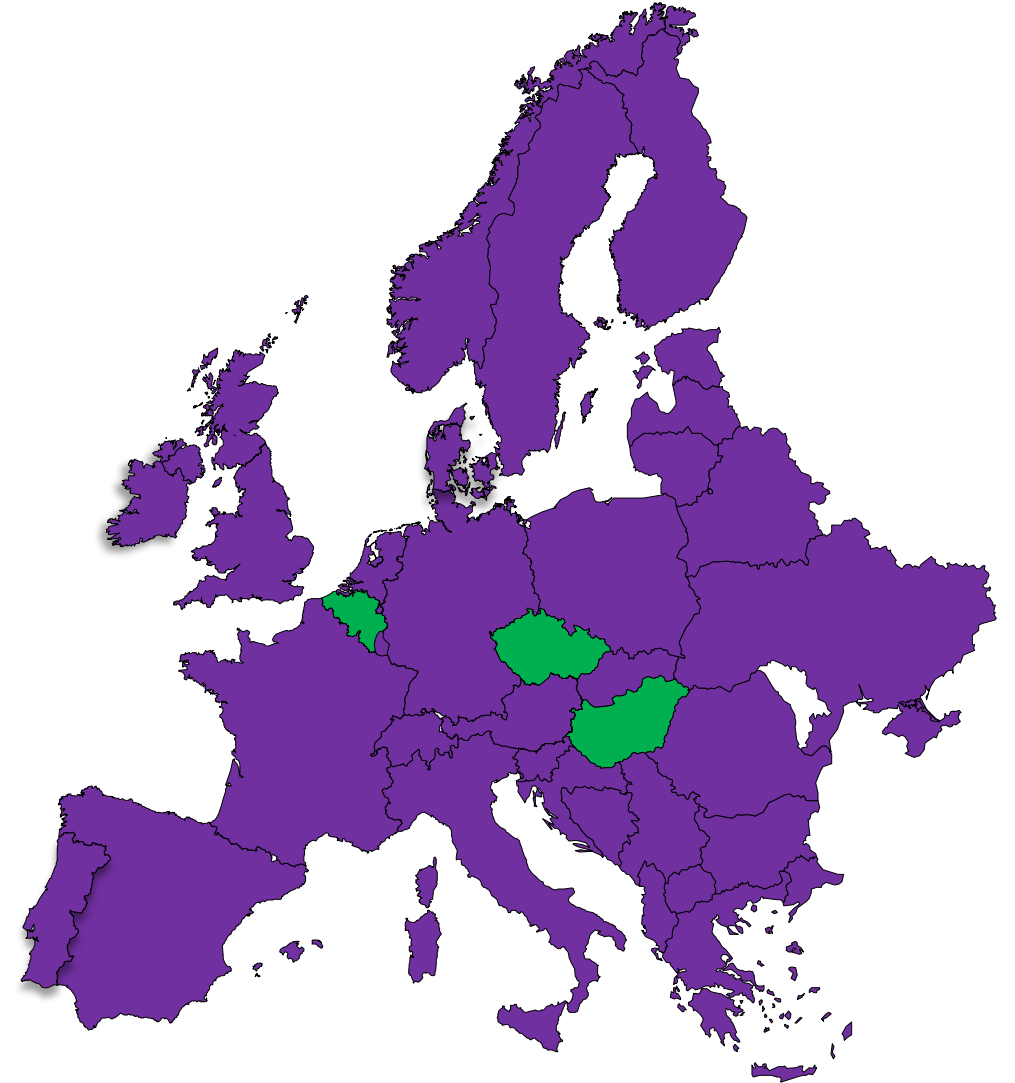
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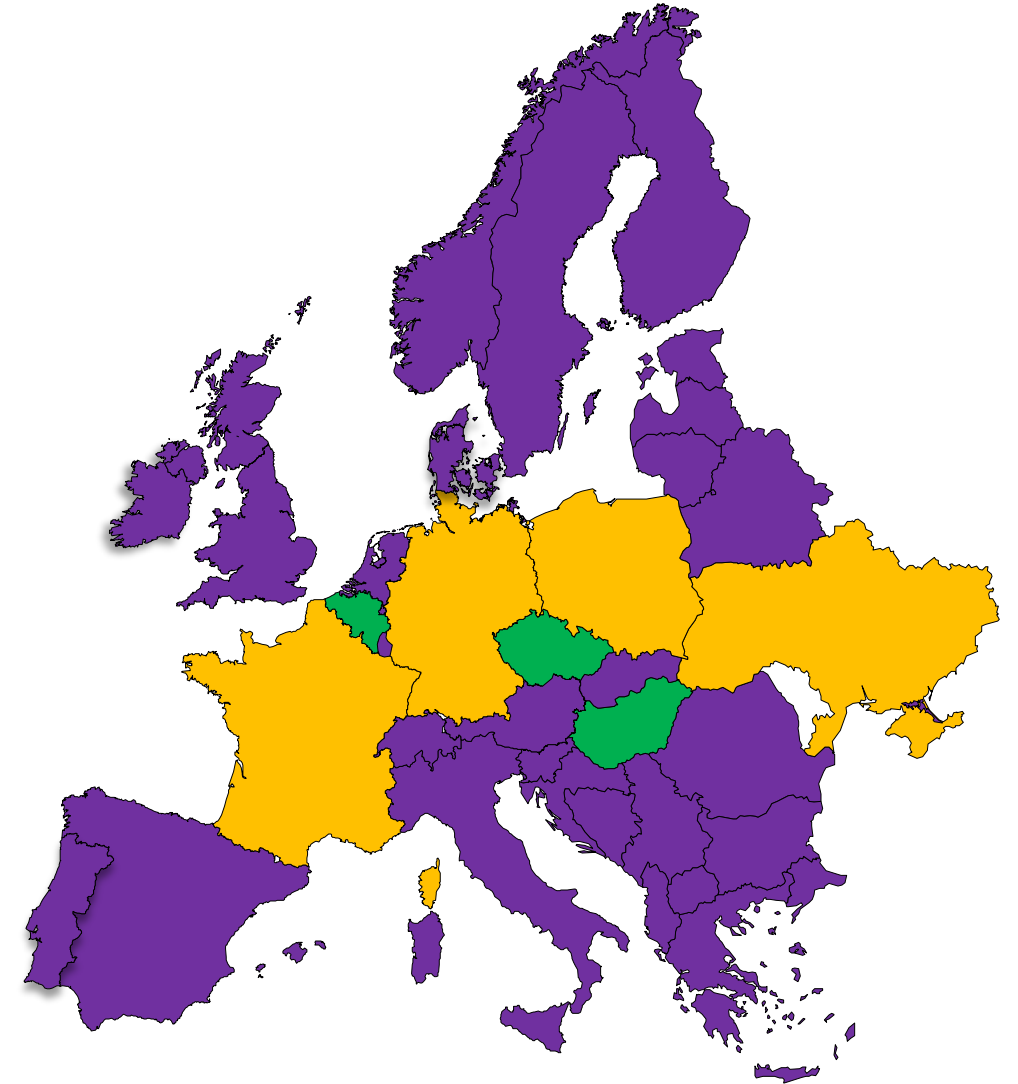
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# 1. Current Situation in Europe

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- Now operational in Hungary and Wallonia (Belgium)
- On the road to implementation in France, Germany, Poland, Ukraine, Russia
- And many others are in the early stages of preparation



## 2. Sources of WIM Inaccuracy

The challenge is to **guarantee** that nobody is wrongfully sanctioned for overloading

- 100% within maximum permissible error
- But in practice, may be 99% or 99.9% if agreed with legal metrology

Inaccuracy can come from:

- the sensor,
- the road,
- the environment and
- the driver/vehicle.

## 2. Sources of WIM Inaccuracy

### The Sensor

- With the best available sensors, the error contribution of sensors is relatively low
- Error can be reduced by using multiple (e.g., 3 or 4) sensors



## 2. Sources of WIM Inaccuracy

### The Road

- Deflection (affects both accuracy and durability of sensors)
- Slope
  - Front to back (drive-axle torque; braking)
  - And left to right
- Curve
- Roughness (inducing vehicle dynamics)

## 2. Sources of WIM Inaccuracy

### The Road

- The COST323 standard specifies requirements for a 'Class I' site:
  - Longit slope < 1%
  - Transv slope < 3%
  - Rad of curvature > 1000 m
  
- Also OIML R134 & ASTM E1318-09

			I Excellent
<b>Rutting</b> (3 m - beam)		Rut depth max. (mm)	≤ 4
<b>Deflection</b> (quasi-static)  (13 t - axle)	Semi-rigid Pavements	Mean deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 15 ± 3
	All bitumen Pavements	Mean deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 20 ± 4
	Flexible Pavements	Mean deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 30 ± 7
<b>Deflection</b> (dynamic)  (5 t - load)	Semi-rigid Pavements	Deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 10 ± 2
	All bitumen Pavements	Mean deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 15 ± 3
	Flexible Pavements	Mean Deflection (10 <sup>-2</sup> mm) Left/Right difference (10 <sup>-2</sup> mm)	≤ 20 ± 5
<b>Evenness</b>	IRI index	Index (m/km)	0 - 1.3
	APL <sup>(1)</sup>	Rating* (SW, MW, LW)	9 - 10

## 2. Sources of WIM Inaccuracy

### The Road

- The road has a key influence on WIM system accuracy
- Every precaution should be taken to ensure that the road is suitable (tests of geometry and pavement condition)

## 2. Sources of WIM Inaccuracy

### The Environment

- Snow/ice, sand, mud
  - Can reduce sensitivity
  - Add to road roughness
- Road temperature – if sensors are temperature-sensitive
- Wind
  - Headwind can distribute weight between axles
  - Gusts can induce vehicle dynamics

## 2. Sources of WIM Inaccuracy

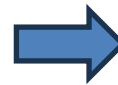
### The Vehicle/driver

- Vehicle dynamic properties (suspension & tyre stiffnesses)
- Load properties (e.g., liquids or liquid due to rain in bulk materials)
- Uneven driving (braking/accelerating, deliberate or not)
- Lane changing (deliberate or not)

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#### COST 323:

- Avoid areas where speed changes (e.g. traffic lights)
- Avoid areas where no. lanes change
- Monitor lateral position

## 3. Methods to Control Accuracy

- Maintenance
- Quality Assurance
- Frequent in-service verifications

## 3. Methods to Control Accuracy Maintenance

- Coordination & compliance with maintenance schedules
  - Road
  - Sensors
  - Electronics & software
- Documentation to prove regular maintenance

## 3. Methods to Control Accuracy Quality Assurance

- These are pre-defined processes/ algorithms to identify, correct for or discard suspect results
- Extends principles of **measurement interlocks** (OIML R134)
- Validation of (i) equipment, (ii) environment & (iii) driver behaviour
- For example, CAMEA system has >36 'validation flags'

# 3. Methods to Control Accuracy

## Quality Assurance

Examples of measurement correction :

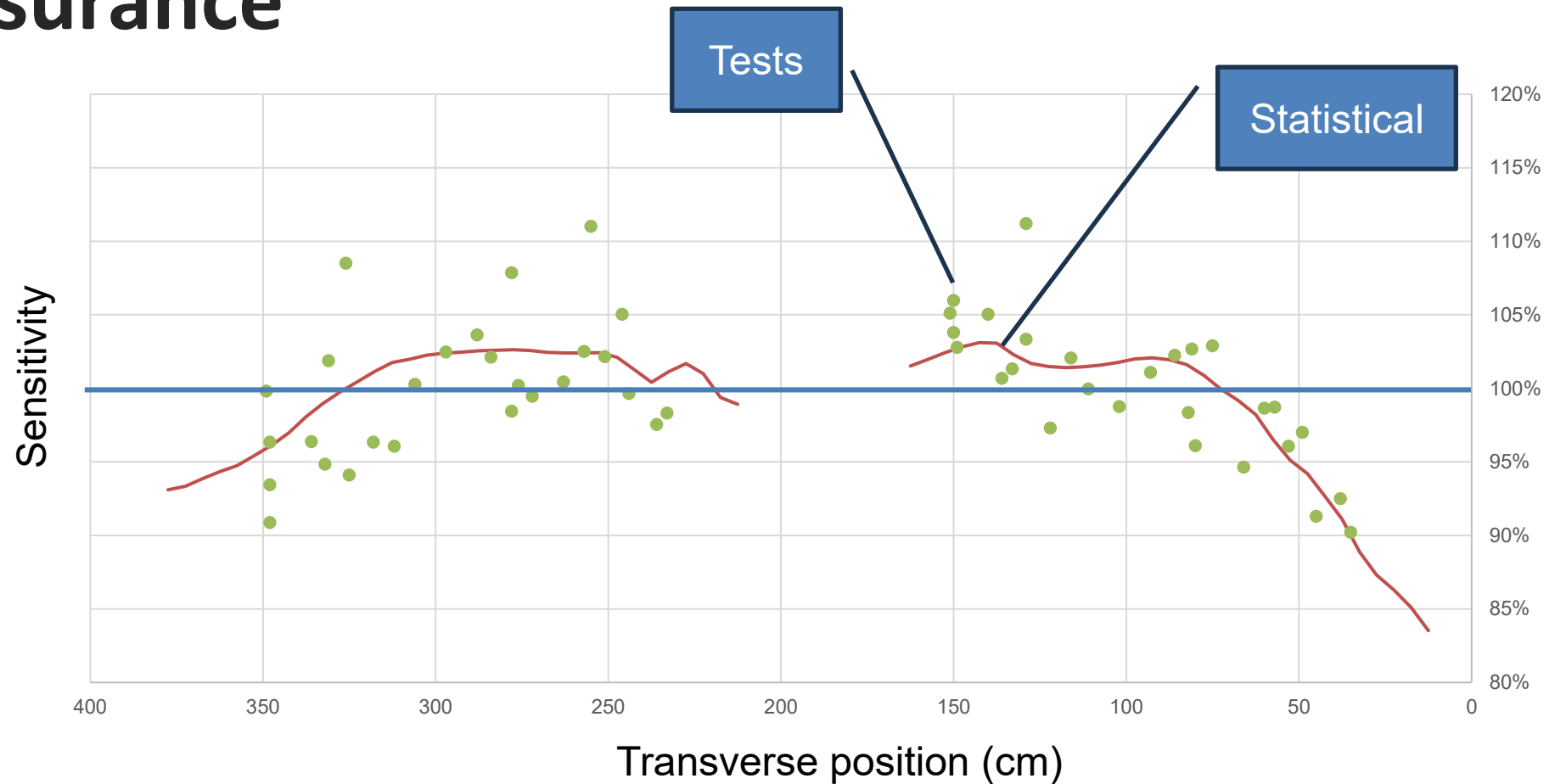
- Correction for speed
- Correction for temperature
- Correction for chassis dynamics
- Correction for transverse position of vehicle on road

# 3. Methods to Control Accuracy Quality Assurance

Courtesy of Dr Emil Doupal, RTS

Examples of correction :

- Correctio
- Correctio
- Correctio
- Correctio  
position c



## 4. Type Approval

- OIML R134 is a recommendation but forms the basis for a national standard
- Type approval consists of:
  - Laboratory tests
  - Field tests
  - Documentation

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- 
- Accuracy
  - Electrical - Insensitivity to environment
  - Simulated field conditions

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- Type approval consists of:
  - Laboratory tests
  - Field tests
  - Documentation
- Full field tests of accuracy in operational conditions
- Statically weighed vehicles passing over WIM system
- Sensitivity to environment
- Maximum Permissible Error



## 4. Type Approval

- OIML R134 is a recommendation but forms the basis for a national standard
- Type approval consists of:
  - Laboratory tests
  - Field tests
  - Documentation 
  - Document system design, functioning, outputs, interfaces and operation

## 5. Technical & Operational Issues

### Commonly used methods to circumvent accurate weighing

- Shoulder running
- Low/high speed running
- Stopping
- Changing lanes/ running between lanes
- Truck trains forming
- Fast lane running
- License plates covering

## 5. Technical & Operational Issues

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### Counter measures

- Additional sensors between lanes (virtual lanes)
- Extended speed range
- Legislation – avoidance as a violation

# 5. Technical & Operational Issues

## Legal Challenges

- Attacks on offence data
  - Time of offence (matching data with picture)
  - Match of the tractor & trailer
  - Vehicle pictured before/after weighing
  - Errors/inaccuracies in miscellaneous data
- Attacks on legislation
  - Not knowing about enforcement
  - Attacks on basis of speed range
- Attacks on type approval
  - Approval/verification documentation
  - Accuracy at a particular time
  - Supplying 'independent' weighing data that contradicts WIM data

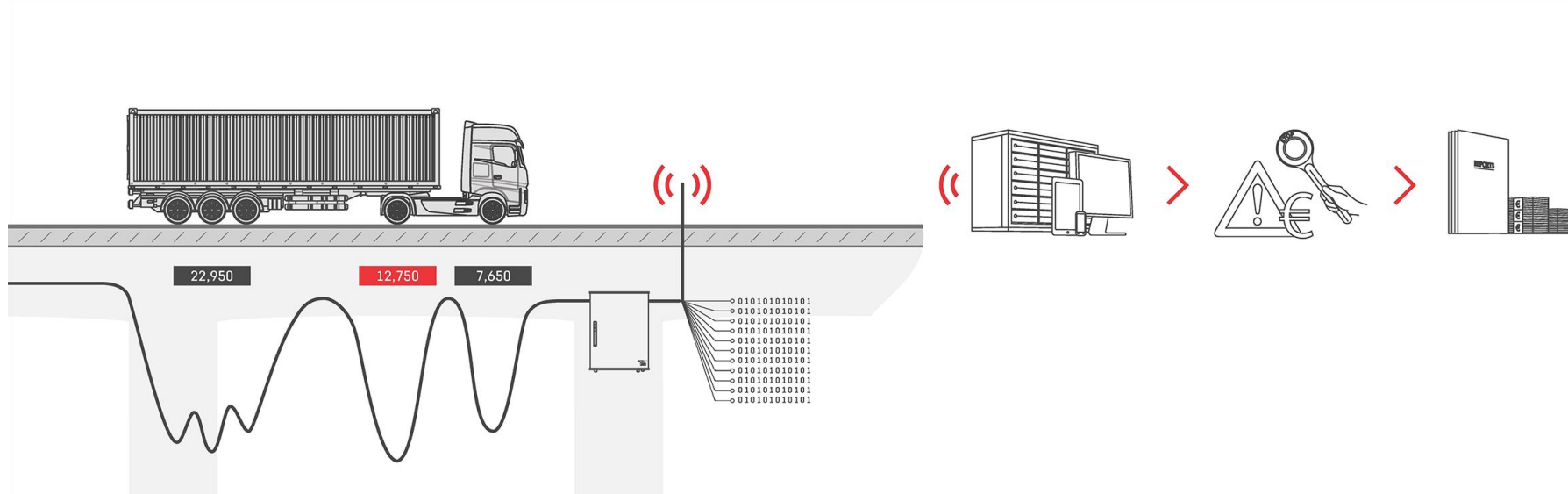
## 6. Enforcement Using Bridge WIM

- Europe is a world leader in Bridge WIM
- Cestel is in the process of obtaining OIML R134 type approval
- However, the process is complex – not clear when it will be approved
- It is planned to use Bridge WIM for enforcement of Gross Vehicle Weight only
- Axle loads are measured but accuracy is sensitive to dynamics



## 6. Enforcement Using Bridge WIM

- Bridge WIM is portable – it can be installed in about 8 hours
- If used for enforcement, this greatly enhances its potential as a deterrent



## 7. The SETO Project

- Smart Enforcement of Transport Operations (SETO) is a Horizons Europe project (2023-2026)
- The goal is for smooth enforcement as vehicles and vessels cross (European) borders
- It covers road, rail & waterways and many types of enforcement, including tachograph, driver licencing, etc.



Discover more at

[www.setoproject.eu](http://www.setoproject.eu)

## 7. The SETO Project

Two activities are of interest in the context of WIM

- A new ‘tamper-proof’ approach to on-board weighing. The goal is to facilitate the sharing of weight and location data with enforcement authorities (like Australian system)
- A ‘Blue Guide’ for processes and best-practices for enforcement of overload using WIM



Discover more at

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## 8. Conclusions

- Enforcement by WIM is expanding – slowly – in Europe
- Things would improve if the approach were harmonised across the European Union
- Procedures need to be standardised and well documented



# Thank you!

The assistance of Dr Emil Doupal and RTS are gratefully acknowledged