



ISWIM NEWSLETTER

Message from the ISWIM president

ISWIM Members and Friends,

Welcome to the first edition of our Newsletter for 2023. ISWIM produces this Newsletter to inform its membership and the broader community about the developments within the association and to provide a snapshot of the world of Weighing-In-Motion (WIM).

This edition is another bumper issue advising across the latest issues and with a specific focus on direct enforcement technologies and experiences across a number of countries. And of course an update on our forthcoming ISWIM joint conference with HVT Forum - **Technology Convergence 2023, Setting the wheels in motion – Reimagin-ing the future of heavy vehicles, roads and freight.**

The ISWIM Newsletter is your newsletter and your articles, research initiatives, programs and learning's are very welcomed. Thank you all for your contribution.

Chris Koniditsiotis, President of ISWIM

■ [Chris Koniditsiotis](#) | ChrisK2.0@bigpond.com

Young Researcher Award

Two young scientists (Amin Moghadam and Lucas Franceschi) have received the ISWIM Young Researcher Award. They have been selected based on their contribution to the Weigh-In-Motion (WIM) field and passion through their studies or early professional life. ISWIM will fully sponsor them to attend the Technology Convergence 2023 conference in Brisbane, Australia to present their work, visit the exhibition, and further develop their industry knowledge and global network.

Lily Poulidakos, Chair ISWIM Young Researcher Award Committee.

■ [Lily Poulidakos](#) | Lily.poulidakos@empa.ch

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Technology Convergence 2023

Setting the wheels in motion – Reimagining the future of heavy vehicles, roads and freight.

The joint conference 'Technology Convergence 2023' in Brisbane, Australia being hosted by the ISWIM with HVTT Forum and is approaching. And with over 100 abstracts from authors across the globe, and strong interest local and internationally, the joint conference is shaping up to be a major event. Here's some important information to help delegates prepare for the joint conference.



1. When will it be held?

The conference will run from 6 to 10 November 2023. Key dates and times are:

- A welcome function will be held on the evening of Monday 6 November (commencing at 6pm Brisbane time).
- The official opening plenary session will occur on the morning of Tuesday 7 November (between 9am and 10:30 am).
- The conference will close on the afternoon of Friday 10 November (5 pm).

2. Where will it be held?

- The conference is being held at the Brisbane Convention & Exhibition Centre (BCEC). Further information about the BCEC is available here: Brisbane Convention & Exhibition Centre (www.bcec.com.au).
- The BCEC is located on the southern side of the Brisbane River in area known as 'South Bank'. Further information about South Bank is available here: www.visitbrisbane.com.au.

3. What is the conference pricing?

- Early bird delegate price will be AU\$1,600 plus GST (VAT), and will be available until end of August 2023. Post this date the delegate price will be AU\$1,950 plus GST.
- Day tickets will also be available prior to and during the conference.
- Arrangements for online ticket purchases are currently being finalized, and will be announced soon!

Disclaimer

The projects described, ideas shared, and claims made in this Newsletter do not necessarily represent the official view or position of ISWIM.

While care has been taken in the preparation of the content of this Newsletter, ISWIM accepts no responsibility in its use, for any omission, or damage that may be caused and does not endorse any specific product or result presented in the Newsletter.

ISWIM Website

Please visit the official ISWIM website: www.is-wim.net. Here you will find information on our society, all Newsletters, past ISWIM Events, the Guide for Users of WIM and links to our all Vendors & Consultants.

New is our online, searchable library with over 300 articles, papers and reports related to Weigh-In-Motion.

ISWIM LinkedIn Group

Besides the new ISWIM website and the periodical Newsletter there is another way of keeping up to date with the latest developments in Weigh-In-Motion; the ISWIM LinkedIn Group.

In this group, researchers, end-users and vendors can find AND post short articles on initiatives, new projects, test result, or other developments related to WIM-technology, applications and data.

The ISWIM LinkedIn Group has currently more than **450** members. If you want to join, please visit:

[linkedin.com/groups/13400438](https://www.linkedin.com/groups/13400438)



View of Brisbane, Australia.

4. What accommodation options are available?

- There are numerous accommodation options available within walking distance to the Brisbane Convention and Exhibition Centre. Suggested hotels are presented below (in alphabetical order):
- Emporium, Novotel, Mantra, Menso, Riverside, Rydges.

5. Sponsorship and exhibition opportunities

- A showcase exhibition for manufacturers, users, government agencies and related industries will be held in conjunction with the joint conference.
- A limited number of spaces are available so get in touch by contacting Andy Lees at: andrew.lees@q-free.com.
- Details of sponsorship opportunities will also be announced shortly.

6. When will the program be available?

- The program is currently being finalized and will be distributed soon.

7. What if I need a formal letter of invitation to attend the conference?

- A formal letter of invitation can be arranged by contacting Gavin Hill on gavin.hill@tca.gov.au.

A reminder for authors: Full papers for accepted abstracts need to be lodged by 31 March. We look forward to receiving them!

The latest information on the conference, papers, program, registration for delegates, possible sponsoring and participating in the exhibition will be made available on: www.is-wim.net, www.linkedin.com/groups/13400438/ and www.hvtt.org or contact the authors:

Chris Koniditsiotis, President of ISWIM and Co-chair Organising Committee.
Gavin Hill, Vice-President HVTT Forum and Co-chair Organising Committee.

■ **Chris Koniditsiotis** | ChrisK2.0@bigpond.com

■ **Gavin Hill** | GavinH@tca.gov.au

Integrated, portable road-weather and traffic information system in Manitoba, Canada

The effects of weather and road conditions on driver behaviour, traffic patterns, and traffic safety are generally acknowledged, but a lack of micro-scale data precludes evidence-based decisions. In November 2022, the Urban Mobility and Transportation Informatics Group (UMTIG) at the University of Manitoba, in partnership with the National Research Council of Canada (Artificial Intelligence for Logistics Program), International Road Dynamics (IRD), and Manitoba Transportation and Infrastructure (MTI), deployed a portable road-weather information system (RWIS) and integrated video classification cameras at an existing WIM installation. The integrated equipment is capable of recording time-synched data, including road surface condition, surface temperature, surface grip and ice/snow/water layer thickness, air temperature, rain state, humidity, wind speed and direction, visibility, and precipitation details. Simultaneously, the system records live video, counts and classifies vehicles (by lane), and retains the individual vehicle records generated by the WIM system.

ISWIM Vendors

APM	www.apm.pl
Axtec	www.axtec.co.uk
Betamont	www.betamont.sk
CAMEA	www.cameatechnology.com
Captels	www.pesage-captels.com
Cestel	www.cestel.eu
Ciemsas	www.ciemsas.com.uy
Cross	www.cross.cz
Dynaweigh	www.dynaweigh.com
ECM	www.ecm-france.com
Excel Technology	www.exceltech.com.au
GEC Scales	www.gecscales.com
Girwim	www.girwim.com
Intercomp	www.intercompcompany.com
IRD / PAT Traffic	www.irdinc.com
iWIM	www.iwim.it
Kistler	www.kistler.com
Mikros	www.mikros.co.za
Osmos Group	www.osmos-group.com
Q-free	www.q-free.com/products
Sterela	www.sterela.fr
TE Connectivity	www.te.com
TDS	www.traffic-data-systems.net
Tramanco	www.tramanco.com.au
VanJee Technology	www.wanji.net.cn

Interested to join the ISWIM Vendors, just contact:

■ **Andy Lees** | andrew.lees@q-free.com

■ **Hans van Loo** | hans.vanloo.int@gmail.com



Portable road-weather and traffic info system deployed in Canada

In preparation for the first deployment, the research team worked closely with technicians from IRD and MTI to select a suitable sampling location with access to power and to complete initial calibration and equipment setup. The system's initial deployment is on a four-lane divided highway near the city of Winnipeg that serves as a major regional trucking route. Since its deployment, the system has generated an initial data set which will undergo validation as a next step. Ultimately, the data will support investigations about the impact of adverse road-weather conditions on truck operations and safety, the contribution of weather-related parameters to network resilience, and the effect of weather conditions on traffic data collection.

■ **Musharraf Khan** | khanma2@myumanitoba.ca

■ **Jonathan Regehr** | jonathan.regehr@umanitoba.ca

■ **Babak Mehran** | babak.mehran@umanitoba.ca

New Axtec Dynamic Weighbridges deliver efficiencies for Wiltshire Council

The UK's leading axle weighing specialist, Axtec, has supplied two of its new, state-of-the-art Dynamic Axle Weighbridges as part of a 'ground-up' refurbishment at Wiltshire Council's salt depots in Warminster and Chippenham.

Axtec took full responsibility for the weighbridge installation including ground works and the laying of flat slabs to highly accurate tolerance levels, in sympathy with, and as determined by, the existing yard levels.

Axtec's dynamic weighbridge allows a six-axle tractor and trailer combination, for example, to provide a complete vehicle weight in just 40 seconds and to obtain individual axle and a gross vehicle weight to an accuracy of +/- 0.5% - one of the most accurate dynamic weighbridge in the UK and Europe. The driver simply drives over the flush mounted platform at a constant speed of 2.5 mph before obtaining instant weight figures from a digital read-out.

ISWIM Consultants

Corner Stone | www.corner-stone-int.com

FIMAU | www.FIMAU.com

NMi | www.nmi.nl

RTS GmbH | doupal@hispeed.ch

Static Motion | www.staticmotion.co.za

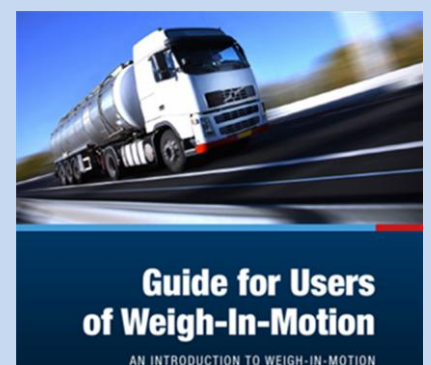
Interested to join the ISWIM Consultants, just contact:

■ **Andy Lees** | andrew.lees@q-free.com

■ **Hans van Loo** | hans.vanloo.int@gmail.com

ISWIM Guide for Users of WIM

The ISWIM Guide for Users of Weigh-In-Motion serves as a basic, yet comprehensive introduction to Weigh-In-Motion. The Guide covers different aspects related to the working, specifying, buying, installing, testing, maintaining and using of WIM systems and data. To enhance accessibility for users starting with WIM, these topics are described in easy-to-understand language.



A PDF version of the WIM User Guide can be downloaded at the ISWIM website: www.is-wim.net.

■ **Hans van Loo** | hans.vanloo.int@gmail.com



Axtec's dynamic weighbridge in the UK

With accurate and rapid vehicle weighing a prerequisite for Wiltshire Council, its gritting vehicles are weighed before departure and upon return to ensure compliance with the Road Vehicles (Authorized Weight) Legislation, and to determine salt quantities according to specific routes.

Before weighing, each driver presses an RF key-fob to automatically enter the vehicle fleet number, further speeding up vehicle throughput, eliminating potential driver error and adding to site safety, while Large Remote Displays are positioned to provide the driver with axle and gross vehicle loads as they pass over the Axtec weighbridge. Weight tickets are printed on demand, and all relevant data is stored for future scrutiny.

■ [Alasdair Littlejohn](#) | Salesadmin@axtec.co.uk

GirWIM – Weight Enforcement Solutions

The Girwim division of the Giropès group is deeply committed to the development of WIM weighing solutions for direct weight enforcement. While various technologies and national legislations for weighing systems in their different versions are being developed and improved, we are implementing our Full Weigh Stations for overload enforcement.

In our Full Weigh Stations Concept, we conduct high-speed vehicle pre-selection with accuracies of 10-15% for Gross Vehicle Weights (GVW). There, we implement control gantries where we integrate different elements such as cameras, scanners, gauge control, variable message signs, etc.

Potentially overloaded vehicles are redirected to low-speed weighing stations, where we have low-speed weighing solutions certified by OIML R-134 with an accuracy of 0.5B. The LS WIM stations operate at 20 km/h and certified to operate at speeds of 10 km/h with precision of +/-1% GVW and 0.5% in static mode.

Coming Events (subject to change)

CVSA Workshop

Memphis, Tennessee, USA
23-27 April 2023
www.cvsa.org/events

Southern African Transport Conf.

Pretoria, South Africa
10-13 July, 2023
www.satc.org.za

IWSHM-14

Stanford, California, USA
12-14 September 2023
<https://iwshm2023.stanford.edu/>

PIARC World Road Congress

Prague, Czech Republic
2-6 October 2023
www.piacr.org

ICWIM9 + HVTT17

Brisbane, Australia
6-10 November 2023
www.is-wim.net

Gulf Traffic

Dubai, UAE
21 – 23 November 2023
www.gulftraffic.com

Transport Research Board (TRB)

Washington, USA
7-11 January 2024
www.trb.com

Transport Research Arena (TRA)

Dublin, Ireland
15-18 April 2024
www.traconference.eu

Intertraffic

Amsterdam, The Netherlands
16-19 April 2024
www.intertraffic.com

NaTMEC

Boise, Idaho, USA
2-5 June 2024
www.natmec.org

ITS World Congress

Dubai, UAE
16-20 September 2024
www.itsworldcongress.com

Do you know other WIM-related events?
Please contact:

■ [Hans van Loo](#) | hans.vanloo.int@gmail.com



Installation of GirWIM LS and MS WIM scales in South America

For example, in 2023 we have started the implementation of three full weighing stations in South America. Those stations have a dual pre-selection system at high and medium speeds, and a direct enforcement system, at low speed.

Girwim Giropès integrate the best technologies in their field, working closely with our partners. Our solutions are managed by a comprehensive software called Gesdyn SW, which is already available in over 20 markets and four continents. We also offer Gesdyn WEB, a cloud-based solution that allows information from various stations and control points to be consolidated, as well as Gesdyn API, which facilitates integration with third-party systems and enables relevant authorities to extract and exploit the data.

■ [Jean Paul Belinga](mailto:jpbelinga@giropes.com) | jpbelinga@giropes.com

BISON WIM approved for direct enforcement in Albania

In 2018 iWIM had installed 2 BISON IWIM_50_10 dynamic weighing systems at the Kukës motorway barrier in northern Albania for the operator Albanian Highway Concession (AHC) with full customer satisfaction in these four years. The 2 BISON dynamic weighing systems are installed at a strategic passage point, located on the principal highway for the transport of goods from the sea (port of Durrës) to northern Albania and neighboring Kosovo. Our IWIM50_10 model designed specifically for installations at toll gates with a speed range of 5-50 km/h.

The BISON WIM systems control the 2 gates used for the transit of heavy vehicles in the two directions, north and south, thus detecting the entire mass of commercial transport. In February 2023, the Albanian General Directorate of Metrology performed the first annual verification according to the recently established local legislation and officially recognized the usage of BISON dynamic weighing systems for enforcement purposes. , validating their 10% accuracy class. The 10% accuracy (GVW) for 100% heavy vehicles valid transits, was validated by the Albanian Metrological Directorate. This confirms the accuracy class 10 in our existing OIML R134 certification.

Glossary of Terms

After the 8th International Conference on Weigh-In-Motion (ICWIM8) in 2019 ISWIM has started the development of the ‘Practitioners Series’. The aim of these best practices publication series is to provide WIM practitioners, technicians, and end-users with a series of practical guides illustrating “best practices” about the various aspects involving WIM technology, systems and their applications. All publications will be published via the ISWIM website: www.is-wim.net.



Early 2022 the first guide in the series was published. The ‘Glossary of Terms’, has an overview of definitions of terms frequently used in WIM. ISWIM guide contributors have discussed practices used around the world, some differences in definitions and terms are included, representing the rich spectrum of global WIM practitioners. It does not circumvent any available standard WIM specifications or calibration procedures.

The following Practitioner Guide are expected later this year:

- Calibration of in-road WIM systems
- Selection of in-road WIM Sites

For more information on the ISWIM Practitioners’ Guides contact:

■ [Gustavo Otto](mailto:otto.gus@gmail.com) | otto.gus@gmail.com

■ [Hans van Loo](mailto:hans.vanloo.int@gmail.com) | hans.vanloo.int@gmail.com



BISON installation on the Kukës motorway toll gate

Based on this successfully passed state control, the AHC concessionaire sends the data of the vehicles detected as overloaded by the BISON WIM systems to the local police station which then autonomously provides to sanction the vehicle. Thanks to the innovative fiber optic technology used for BISON WIM systems it demonstrates a durability and stability of functioning, confirming our strong positions both in Italy and abroad and important contribution to the protection of infrastructures and people who travel on the roads.

■ **Luca Trainotti** | luca.trainotti@iwim.it

■ **Elisa Corradi** | elisa.corradi@iwim.it

VanJee WIM for Direct Enforcement in China

In 2021, VanJee won a big WIM bid with 100 million RMB (15 million USD) for Direct Enforcement function in Changde, Hunan China. The project has total 42 Direct Enforcement WIM sites and one central WIM management platform. VanJee has made the WIM project put into service in 2022.



VanJee Direct Enforcement Site in China

WIM Data for Bridge Engineering

In May 2022, ISWIM published its second Practitioners' Guide, 'WIM Data for Bridge Engineering'. Its main goal is to present the possibilities of using WIM data for various bridge applications in an easy-to-understand way.

All WIM data has applications in bridge engineering, whatever the technology used to secure it. Perhaps the most critical application is in traffic loads. With some statistical calculations, WIM data can be used to determine the characteristic maximum load effects on bridges and hence their design values. This has applications in developing traffic load models for countries and finding site-specific design loading for a particular bridge.



The WIM data can also be used to protect bridges with lower load-carrying capacity. It can support posting policy or issuing a warning to heavy vehicles using a variable message sign. WIM, particularly Bridge WIM, can also be used for bridge health monitoring. Having load and bridge performance under this load significantly improves the quality of the information on the overall safety of a bridge structure.

For more information on this ISWIM Practitioners' Guide contact:

■ **Gustavo Otto** | otto.gus@gmail.com

■ **Aleš Žnidarič** | ales.znidaric@zag.si

VanJee has connected 72 Direct Enforcement WIM sites and 10 local weighing stations as well as 20 heavy goods factories' weighing scales into the central WIM management platform. Therefore, the platform provides necessary and sufficient overloaded enforcement evidence for local authorities including vehicles picture, weights, plate number, time, and location. The local authority can monitor every trucks (overload or not, local vehicle or not) on municipal roads. Additionally, the authority would search specific truck plate number and violation records to improve WIM enforcement efficiency.



Changde Municipal Overloading Control Center

The project has comprehensive municipal design to overcome problem of vehicles missing and escaping, data mismatch and data isolation between each local weighing station. There are WIM sites in every key traffic points. Therefore, truck drivers cannot detour route to escape from WIM inspection.

■ **Zhai Zhao** | Zhaizhao@vanjee.net

CROSS WIM System in Hong Kong

CROSS's high speed weigh-in-motion system has left the EU borders again. A long preparatory project was finally realized in windy Hong Kong. Hong Kong city is not only one of the most densely populated places in the world, but is an important economic and business centre.

The installation was realized last autumn and the six lane HSWIM system meets the demanding criteria and ensures accurate measurement results. The installation was realized in cooperation with a local experienced partner Win Promise Ltd under CROSS's professional supervision. This installation was one of the most complex due to the frequent changes in weather, which brings typhoons. The system was finally installed, calibrated and now works properly.



Cross's direct enforcement approved system in Hong Kong

Calibration of WIM systems

This guide is being developed by ISWIM volunteers to assist WIM contractors and transportation agency personnel involved in field WIM equipment calibration. In addition, road owners responsible for developing WIM programs may find this document useful in establishing their specific requirements for a successful WIM operation.

This document will offer recommendations based on proven best practices and published documentation for conducting a successful WIM calibration for in-road and bridge WIM technologies. The purpose of this document is to describe step-by-step procedures to perform an initial or routine calibration of WIM equipment installed for high-speed WIM data collection to support highway monitoring and transportation statistics.



This guide should be used only for systems that are for general traffic monitoring, statistical applications and WIM pre-selection. This guide is NOT aimed at systems used for legal metrology applications such as direct enforcement and does not circumvent any available standard WIM specifications.

The ISWIM Practitioners' Guide will be made available via the ISWIM website: www.is-wim.net

■ **Debbie Walker** | Deborah.Walker@dot.gov

■ **Andy Lees** | andrew.lees@q-free.com

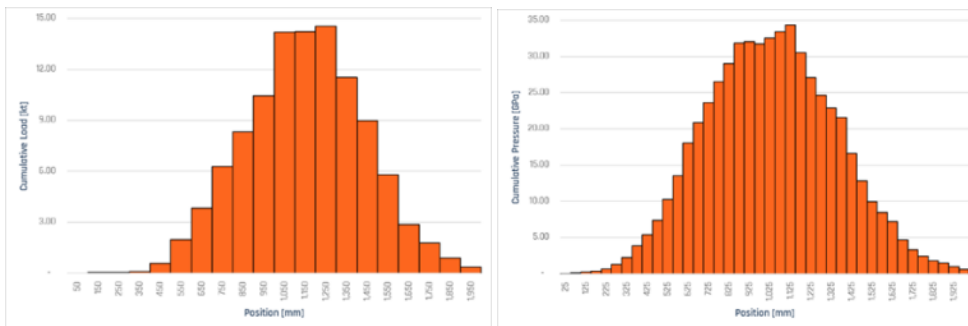
The solution has been installed to measure all vehicles and specially to focus on overloaded trucks to enlarge bridge lifespan and to increase road safety. Integration of other sensors/detectors enhances the CrossWIM solution to another level of measurement and detection.

CROSS's system as a modular solution can combine up to 5 different sensor types from several suppliers in one installation lane and the computing unit can be configured as the customer desires. Lastly, the next planned steps need to be mentioned, which will be aimed at supplying more traffic technologies from CROSS including the smart city central management platform, which can supply cooperative functionalities thanks to customizable pre-set rule engines.

■ Miroslav Kušnir | kusnir@cross.cz

Tire Pressure Measurement using the New CAMEA WIMTRONIC Digital Sensor

Our novel digital WIM sensor detects dual tires, measures wheel position, width, and tire inflation pressure. In order to verify the limits of accuracy that can be achieved, we used a light two-axle truck with narrow tires (195/70 R15), which has small footprint and therefore the largest error in measuring its area. The tests were performed in a controlled manner so that uneven driving of the vehicle could not affect the accuracy of the measurements. Tire pressure measurement with an error within 21 ± 13 kPa (4.8 ± 3.0 %) was achieved.



Cumulative load distribution across a traffic lane

Also, as shown in the left chart shows, the cumulative road load (in kilotons) caused by the vehicle's wheel measured using a 2m sensor, we can see that the maximum load is roughly in the center of the sensor. This is the point through which most vehicle wheels pass - the driving track in which rutting appears. The right chart shows the measured cumulative pressures (in GPa) exerted by the vehicle tires on the road surface. As the results clearly show, WIMTRONIC can measure tire pressure accurately. In combination with precise lateral position, it can measure the cumulative counts, loads and pressures in the transverse profile of the road. Therefore, the data provided allows a more refined assessment of road wear beyond the estimation of ESALs. This opens up new possibilities for load analysis of roads and infrastructure, and for planning their reconstruction, expansion, and maintenance.

■ Jan Fučík | j.fucik@camea.cz

History of International Conferences on Weigh-In-Motion

So far 8 International Conferences on Weigh-In-Motion have been held and the 9th edition is scheduled for November next year in Brisbane, Australia. The conferences are:

ICWIM-1

Zurich, Switzerland
8-10 March 1995

ICWIM-2

Lisbon, Portugal
14-16 September 1998

ICWIM-3

Orlando, Florida, USA
13-15 May 2002

ICWIM-4

Taipei, Taiwan, ROC
20-23 February 2005

ICWIM-5

Paris, France
19-22 May 2008

ICWIM-7

Foz do Iguaçu, Brazil
7-10 November 2016

ICWIM-8

Prague, Czech Republic
19-23 May 2019

ICWIM-9

Brisbane, Australia
6-10 November 2023
www.is-wim.net/events/coming-events/icwim9/

All papers of the past ICWIM conferences can be found at:

www.is-wim.net/library/

For questions, please contact:

■ Hans van Loo | hans.vanloo.int@gmail.com



Intercomp Strip Sensors type-approved for HS-WIM Direct Enforcement in Brazil

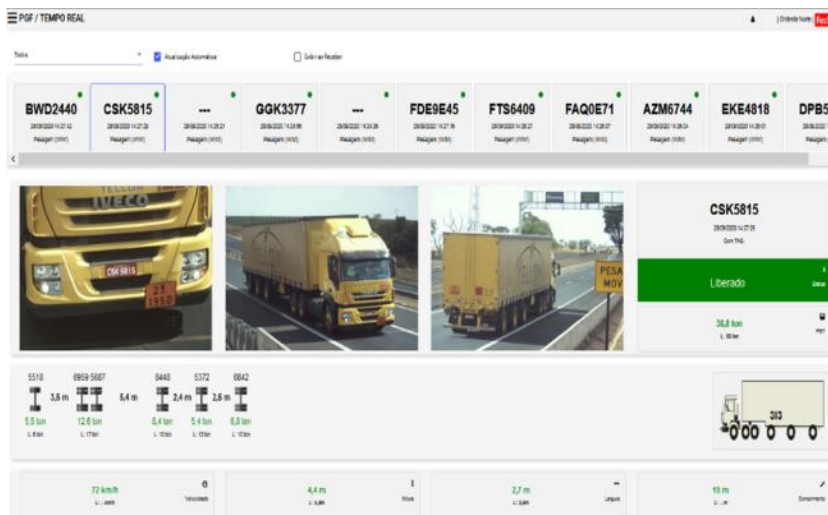
The Intercomp strain gauge strip sensors were introduced in Brazil in 2014 when they went through extensive testing and experimentation in partnership with LabTrans – a leading research institute involved in the development and specification of vehicle weight enforcement programs in Brazil. In 2022, the Fiscal Tech solution with the use of Intercomp Sensors became the first HS-WIM system to be type-approved for direct enforcement in Brazil.

The HS-WIM system was certified for Class 2B, which means $\pm 3.5\%$ for Gross Vehicle Weight (GVW) and $\pm 8\%$ for axle/axle group weight measurements (on initial verification). The national requirements for certification of WIM systems were developed based on OIML recommendations.



HS-WIM system type-approved for direct enforcement in Brazil

As part of the technical development process, Fiscal Tech installed 40 lanes of HS-WIM equipment on roads of ARTERIS concessionaire. These systems allowed data collection and studies to consolidate the first step for direct weight enforcement in Brazil.



Fiscal Tech direct enforcement solution in operation in Brazil

ISWIM Board

Executive Board:

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- Andrew Lees, Great Britain
Vice-President Vendors
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Vendors & Consultants College:

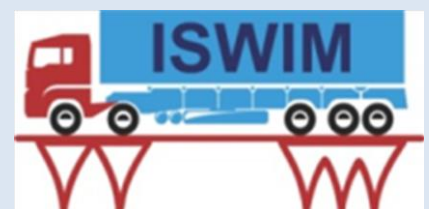
- Andrew LEES, Great Britain
- Rish MALHOTRA, Canada
- Tomas POSPISEK, Switzerland

ISWIM Practitioner's Guides:

- Gustavo OTTO, Brazil

Promotional Activities:

- Hans VAN LOO, Switzerland



After technical developments and metrological certification, the Fiscal Tech solution with the use of Intercomp Strain Gauge Strip Sensors became the first HS-WIM system to be type-approved by the National Metrology Institute (INMETRO) for direct enforcement in Brazil. The experience of Brazil can provide insight to other countries who wish to modernize their weight enforcement strategies.

■ [Leonardo Guerson](#) | leonardog@intercompcompany.com

Multi-Factor Approach to Direct Enforcement

IRD has, for a number of years now, participated in WIM for direct enforcement studies. Establishing system accuracy and reliability is essential to ensuring that standards are set for WIM systems to perform consistently and meet or exceed legal requirements.

While the in-road sensors have been the focus of most studies, multiple factors influence WIM system accuracy. Weather can impact accuracy negatively through temperature variations and snow and ice on sensors and surrounding pavement surfaces. Wind gusts cause vehicles to lean and sway, resulting in measurements outside acceptable tolerances. Accuracy varies by vehicle and load type. Calibrated accuracies can drift over time. These factors can reduce consistency to the point that WIM sensors that meet direct enforcement criteria in ideal test environments fall short of the necessary confidence level in practice.



Referencing static scale data is one way to reduce drift

Mitigating external factors has become a significant focus of IRD's research. Continually improving confidence levels and ensuring ongoing in-specification performance are our current objectives for direct enforcement-ready WIM.

Integrating machine vision and AI technology helps mitigate external effects on weight accuracy. Like automated vehicle researchers, we see the highest confidence resulting from a "multi-modal sensor fusion" approach. In tests with multiple transportation departments, when incorporating a subset of IRD's multi-factor approach, we have observed up to a 10% confidence increase in enforcement-ready WIM measurements.

■ [Tyler Haichert](#) | tyler.haichert@irdinc.com

■ [Rish Malhotra](#) | rish.malhotra@irdinc.com

Two Technologies + Co-operation = One Solution (part 1)

Teamwork in nature and in business always ends up with the correct solution. It is the same with static and dynamic weighing systems.

The ideal solution for monitoring axle loads on vehicles is by implementing cooperative data sharing principles between WIM and OBM system technologies. The WIM checks the OBM's weight data, including the calibration data for tampering and/or errors and vice versa.

Simultaneous crosschecking shares information relating to axle loads, suspension functionality, road irregularities and the rates of degradation in same, and their location.

The efficacy of any "calibration factor" can be determined from the individual vehicles and the DEMs (Dynamic Excursions of Mass) which they are generating. Thus, the "factor" becomes a floating variable based on real inputs per vehicle not a generic or theoretical one.

A suspension in a good state of repair generates DEM factors of 1.2:1 or more of its static mass depending on speed and road conditions. The Australian average is 1.3:1 or more. The same make of suspension, carrying the same static mass and needing repairs will generate DEM factors of 1.6:1 or more.

This article continues on the next page.



First type approval of HS WIM system in Wallonia

In 2014, following a report by the Court of Auditors of the Government of Wallonia highlighting the negative impacts of overloaded vehicles on its road infrastructure, the Public Service of Wallonia (SPW) launched a tender to equip key sections of the region's motorways with High-Speed Weigh-In-Motion (HS-WIM) stations.

STERELA GLOBAL-WIM systems were subsequently deployed in 2015 with the aim of reducing the cost of maintenance due to premature damages to roads, increasing road safety and fighting against unfair competition amongst road freight companies.



Sterela HS WIM for direct enforcement in Wallonia

These stations were initially operated as pre-selection sites but the project included their eventual upgrade to direct enforcement once the type approval process had been completed in order to enforce legal weight limits on a large scale to induce behavioural changes in road users.

Via a development partnership, STERELA and the SPW have worked together to test and characterise the installed systems, collect comparative data, improve algorithms and set up all the parameters of the type approval model to prove the feasibility of WIM direct enforcement.

In 2021, the type approval model for one lane was finally signed off by the legal metrology body of Wallonia. The site of Louvain-La-Neuve equipped with a STERELA GLOBAL-WIM station was successfully type approved to legally weigh moving vehicles, detect and enforce overloading offences without having to intercept the vehicle. This was a world first with regards to the accuracy and the confidence levels achieved (99,8%).

Following this success, the Government of Wallonia has recently announced that they will now upgrade their pre-selection Weigh-In-Motion sites to direct enforcement (and include all lanes) to tackle and resolve the issues created by overloaded vehicles to their road network.

■ **Benoît Géroudet** | benoit.geroudet@sterela.fr

Two Technologies + Co-operation = One Solution (part 2)

The DEM values exponentially increase with the rate of wear in the suspensions and in the roads over which they travel in a true symbiotic relationship.

Based on the known problems a fixed “factor” may not be appropriate. It may not gain any more knowledge than what is being generated now. The fixed factor may also favour one design over the other and so “mass violations” on one WIM may not be recorded as such on another one of a different design. It may lead to prosecutions which could later be proven invalid if the vehicle/s are weighed over a stationary weighbridge and the static mass is less than the recorded in-transit mass.

The Gi-Go saying about computers is true for all electronic data logging apparatuses.

Real-time data histograms can be produced from the DEM data which inform valued judgements to be made about prioritizing infrastructure maintenance costs and/or capital expenditure because the road authorities/owners can quickly assess where the money needs to be spent - also in real time.

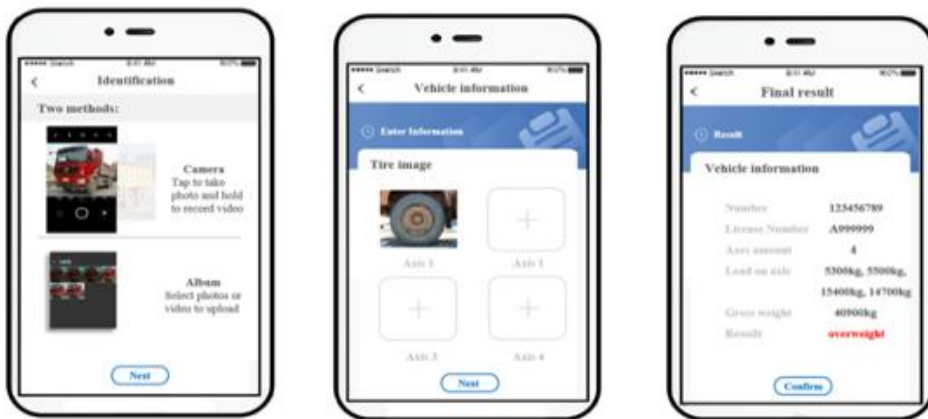
The result is less vehicles on the road and thus less pollution, less road wear, identifiable costs and valued added resource expenditure, thus improving safety for all road users.

■ **Roger P. Sack** | roger@tramanco.com.au



Vision-WIM: A New Technology for Vehicle Weighing

In Hunan University, we have developed Vision-WIM, a non-contact weigh-in-motion method based on computer vision techniques. Firstly, a digital camera is used to capture images of vehicle tires. Then, computer vision and deep learning techniques such as image segmentation, edge detection, and character recognition, are applied to detect the tire and rim edges, sidewall markings, tire vertical deflection, and tire pressure from the images. The obtained parameters are input into the contact force equations to calculate the contact force of each tire. Finally, the vehicle weight including the axle weight and gross weight can be estimated by summing up the contact forces of all the tires. We have also developed an app for smart phones as shown below.



“Vision-WIM” APP

Vision-WIM has the potential to be used in a variety of scenarios. For example, it can be used as a portable weighing tool or can be installed at toll stations for low-speed WIM applications. It could be a perfect choice for heavy-duty or exceptional transport vehicles that have extra large size and are difficult to weigh using the static scale and PWIM.



Weighing different types of vehicles in China

There is also potential for high-speed WIM in the near future. It is portable and requires no lane or road closures, which could make it a breakthrough.

■ Xuan Kong | kongxuan@hnu.edu.cn

Contact ISWIM

Website:

www.is-wim.net

E-mail:

info@is-wim.net

LinkedIn:

linkedin.com/groups/13400438

Newsletter:

hans.vanloo.int@gmail.com

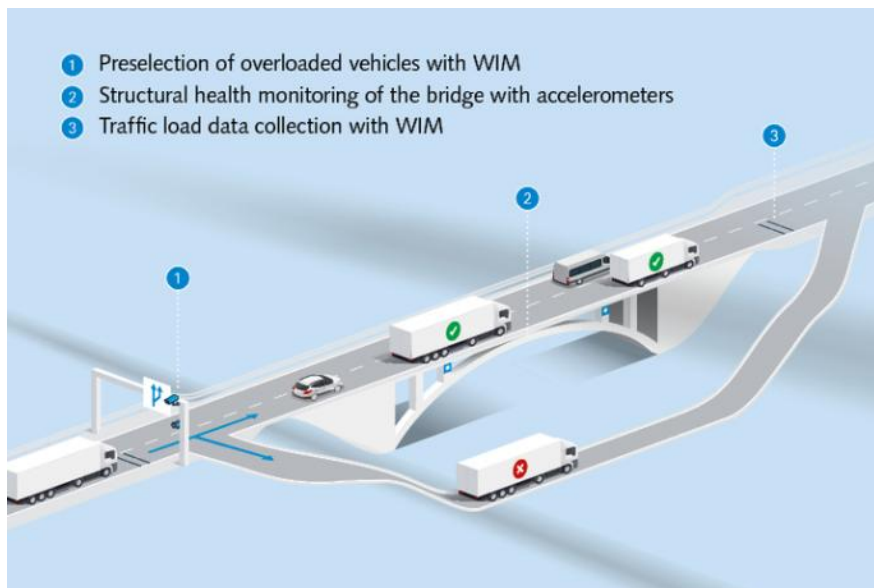


Why bridges need our attention

Weigh In Motion and Structural Health Monitoring protect sensitive infrastructure. Bridges connect people. They promote mobility and enable a rapid exchange of goods and services. But it is evident today that many of these have aged considerably. On top of that, traffic loads on bridges have been growing continuously in many places over the last decades. These conditions often lead to the collapse of bridges, despite regular inspections and repairs. So how can accidents of this nature be avoided, and which technologies are available to protect bridges?

Weigh In Motion for efficient international bridge protection.

A Weigh In Motion (WIM) system is particularly effective in ensuring compliance with regulations. In addition to measuring the overall weight of the vehicle, sensors integrated directly in the road surface also determine the real extent of significant axle loads. This is achieved in moving traffic at normal speeds and in several lanes. Weigh In Motion systems from Kistler are deployed for this reason on many bridges around the world, collecting traffic data and ensuring applicable rules are observed.



Bridge protection with Kistler WIM applications..

Real-time condition monitoring thanks to Structural Health Monitoring

Further technologies such as Structural Health Monitoring (SHM) provide information on the actual condition of the structure. This involves the installation of strain or acceleration sensors at key positions on the bridge to, for example, record vibrations or changes in the construction material. Solutions of this kind enable authorities and bridge owners to monitor the condition of these structures continuously and reliably, and they provide support when planning everything from maintenance management to new constructions.

■ [Christoph Klauser](mailto:Christoph.Klauser@kistler.com) | Christoph.Klauser@kistler.com

