

Verifying Container Weight

What, Where and How?

Lars Meurling

BROMMA

A Tradition of Innovation



Topics

- SOLAS
- Container Weight Verification
 - Options and related issues for weighing in the container terminal
 - Weighing as part of the lifiting cycle - Why/Where/How?
 - Accuracy
 - Business Case



Background



And incidents happen , this is MSC Napoli, 2007.

BROMMA

A Tradition of Innovation

The IMO regulation states



- In force since July 1, 2016
- "The responsibility for obtaining and documenting the verified gross mass of a packed container lies with the shipper".
- "A container packed with packages and cargo items should not be loaded onto a ship to which the SOLAS regulations apply unless the master or his representative and the terminal representative have obtained, in advance of vessel loading, the verified actual gross mass of the container".
- "If the shipper does not declare the correct container weight, then a third party, for example the terminal, may weigh the container and charge the shipper".

Alternatives Available

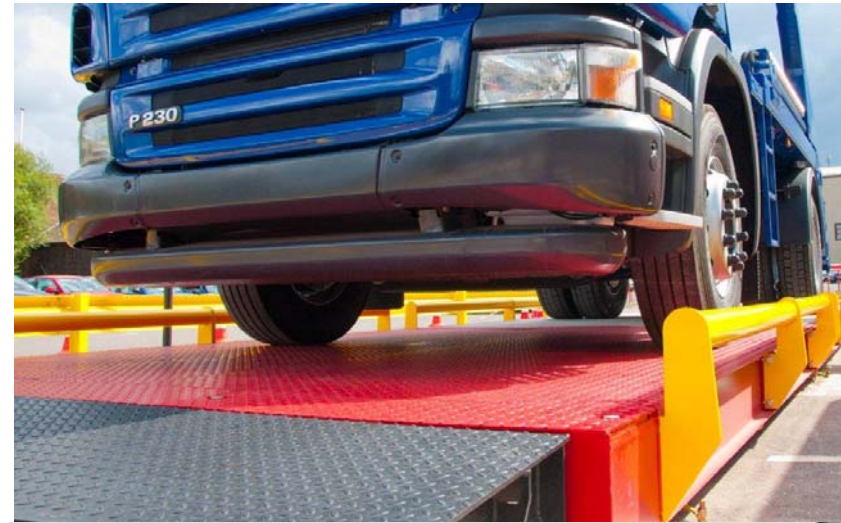


BROMMA

A Tradition of Innovation

Weighbridges

- Inaccuracy: 0,2-0,5% of full scale (FS).
- Can not weigh individual 20ft containers (twinlift).

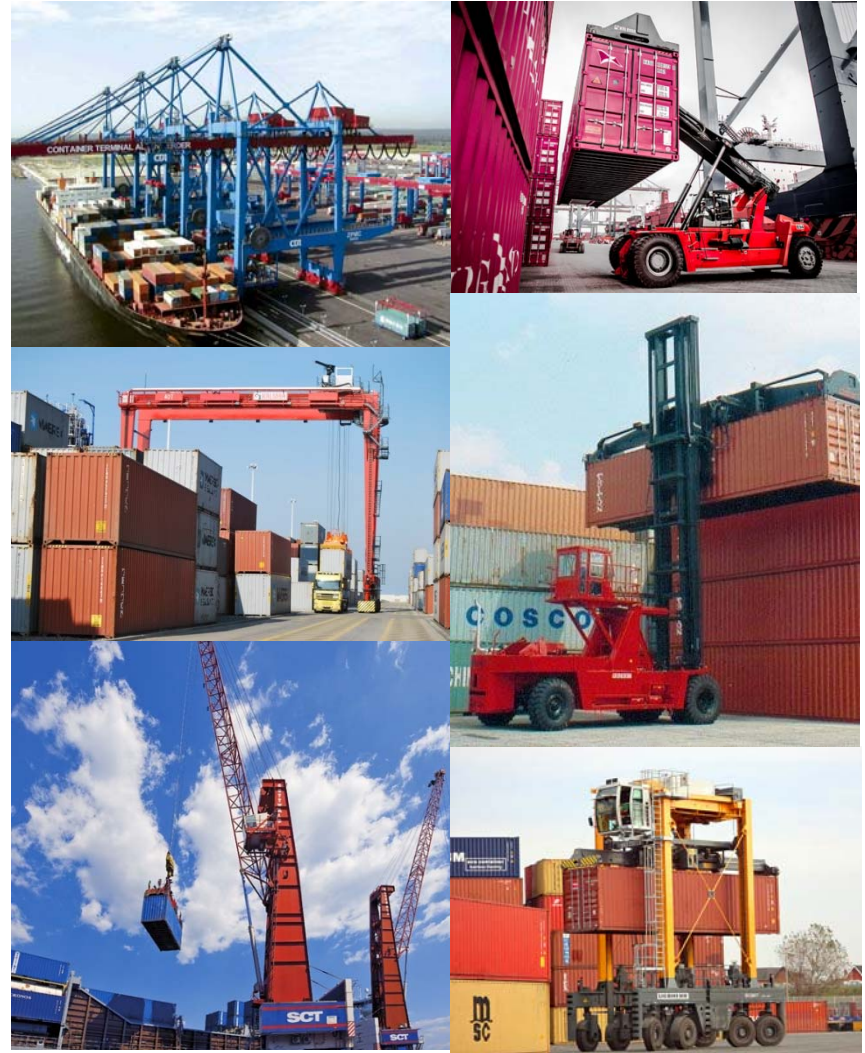


BROMMA

A Tradition of Innovation

Cranes and Mobile Equipment

- Load cells or other means of detecting load
- Non-disruptive to the terminal flow.
- Can not measure individual 20ft containers (twinlift).
- Inaccuracy: 3 – 5% of FS.

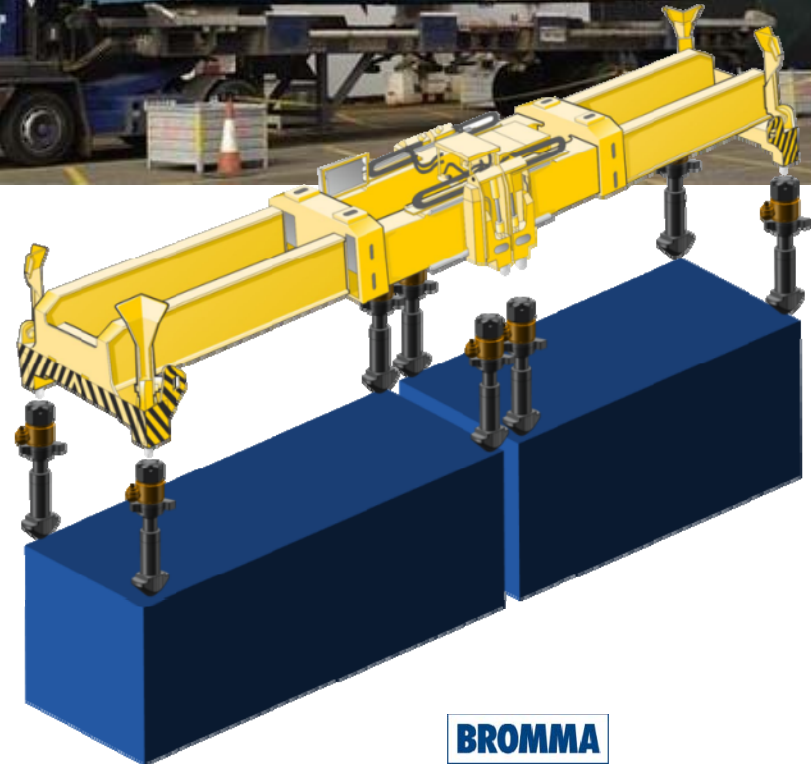


BROMMA

A Tradition of Innovation

Twistlock Weighing Systems

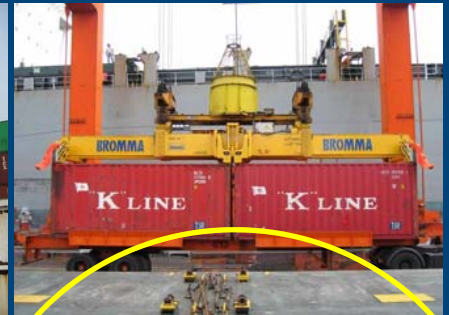
- Non disruptive to the terminal operation – measures during lift cycles.
- Can measure individual 20ft containers in twinlift mode.
- Inaccuracy: 0,5-1% of FS.
- Additional operational safety features.



BROMMA

A Tradition of Innovation

Three main alternatives



	Weigh Bridges	Crane Solutions	Spreader Twistlocks
Accuracy	0,2-0,5% of full scale	3-5% of full scale	0,5-1% of full scale
Twin lift	Only total weight	Only total weight	Individual containers
Effect on terminal operation	Yes	No	No

BROMMA

A Tradition of Innovation

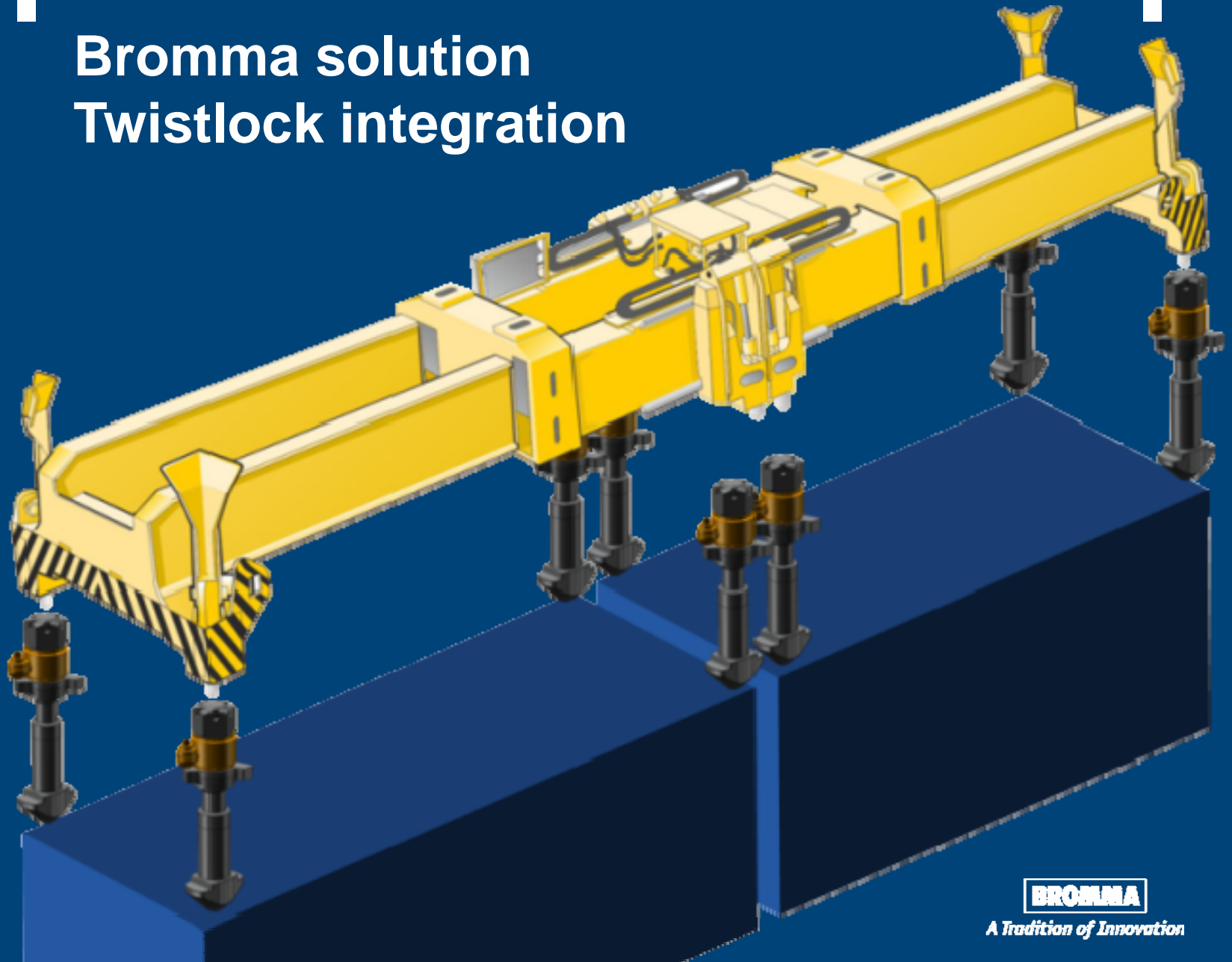
Weighing as part of the lifting cycle



BROMMA

A Tradition of Innovation

Bromma solution Twistlock integration

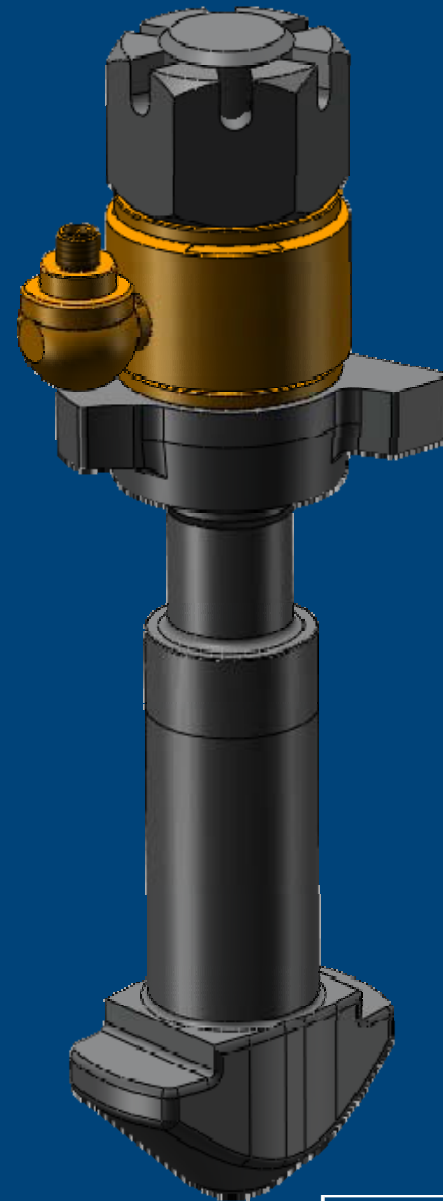


BROMMA

A Tradition of Innovation

Twistlock Assembly

- Perfect mechanical integration by tripod technology
- Established and proven measuring technology

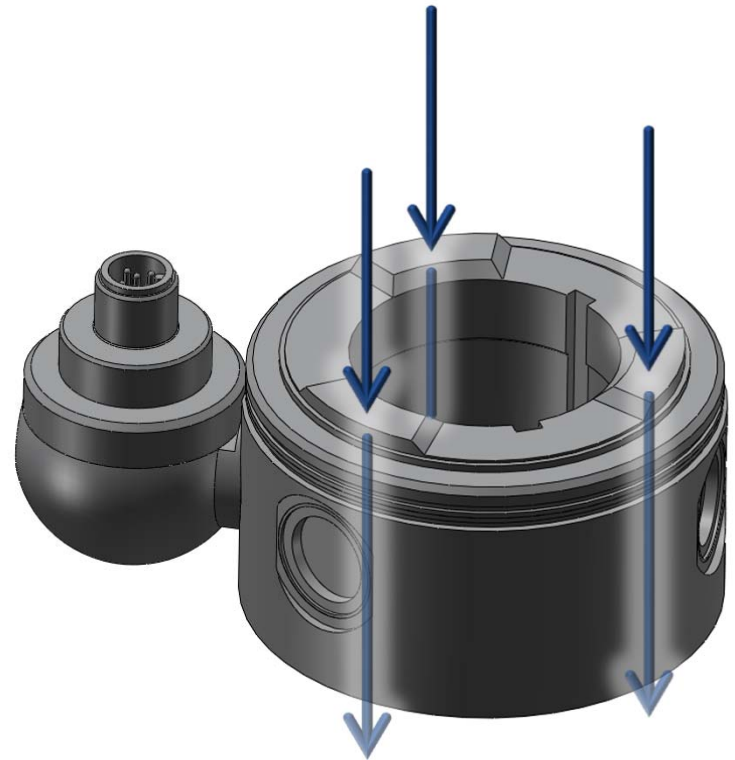


BROMMA

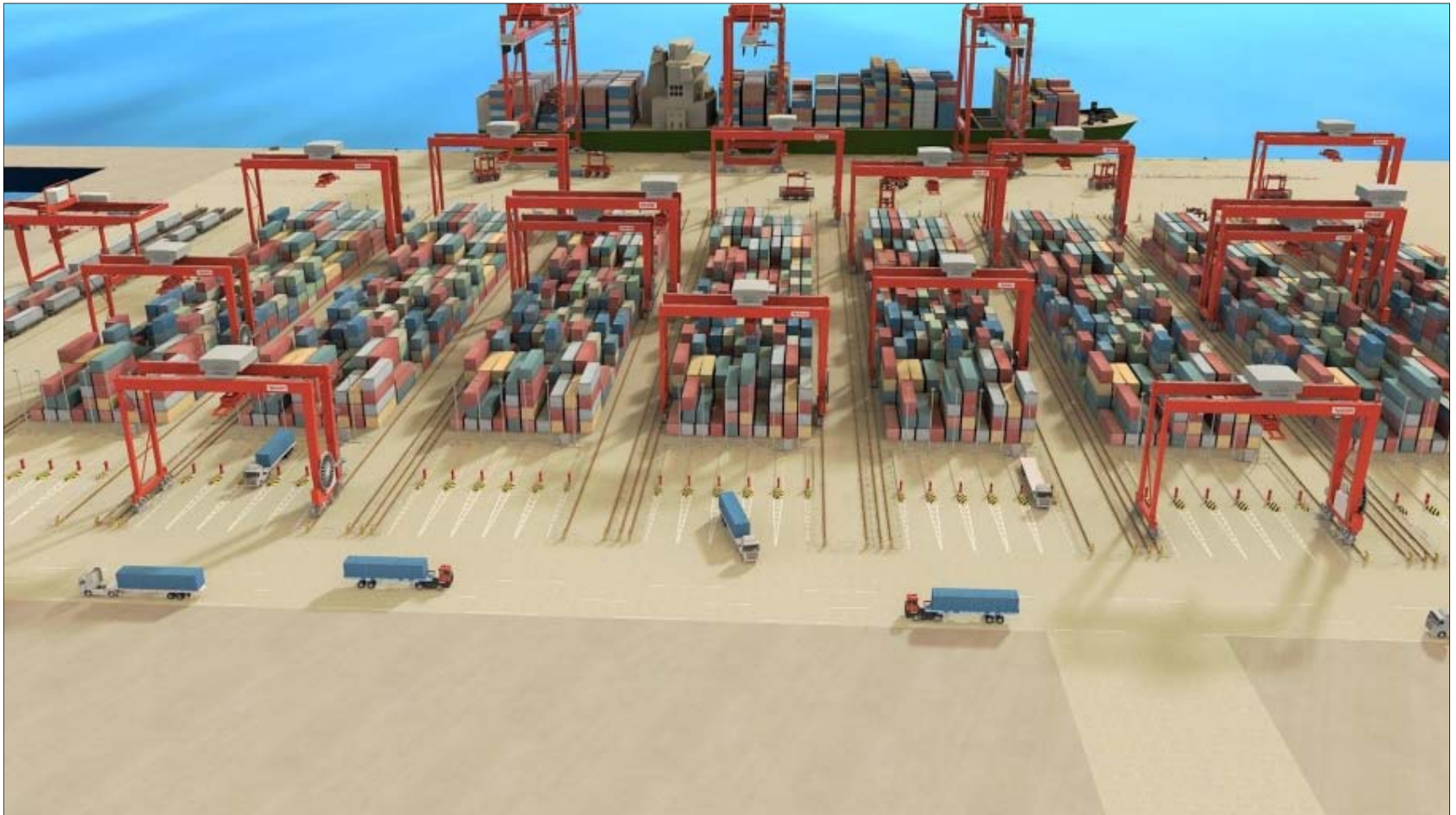
A Tradition of Innovation

Sensor

- Re-useable
- Specified for 2 M load cycles
- Defined force-flow through sensor



Where?

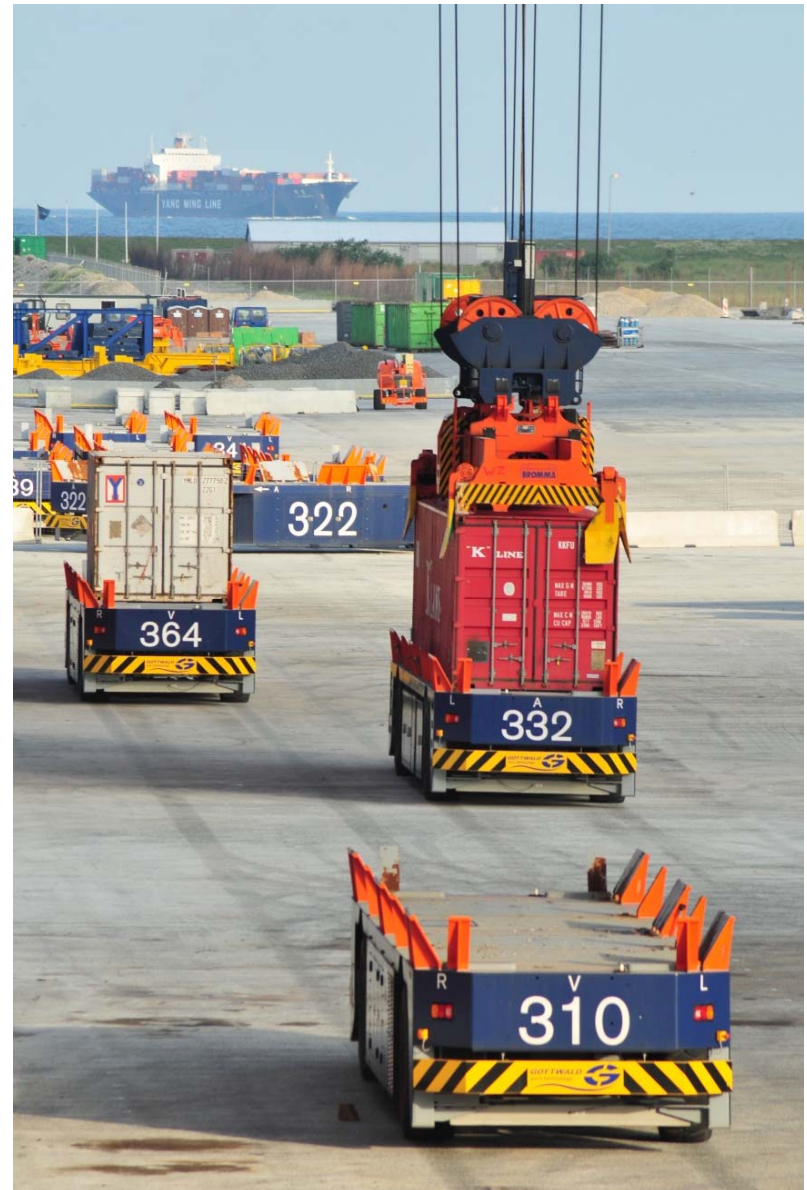


BROMMA

A Tradition of Innovation

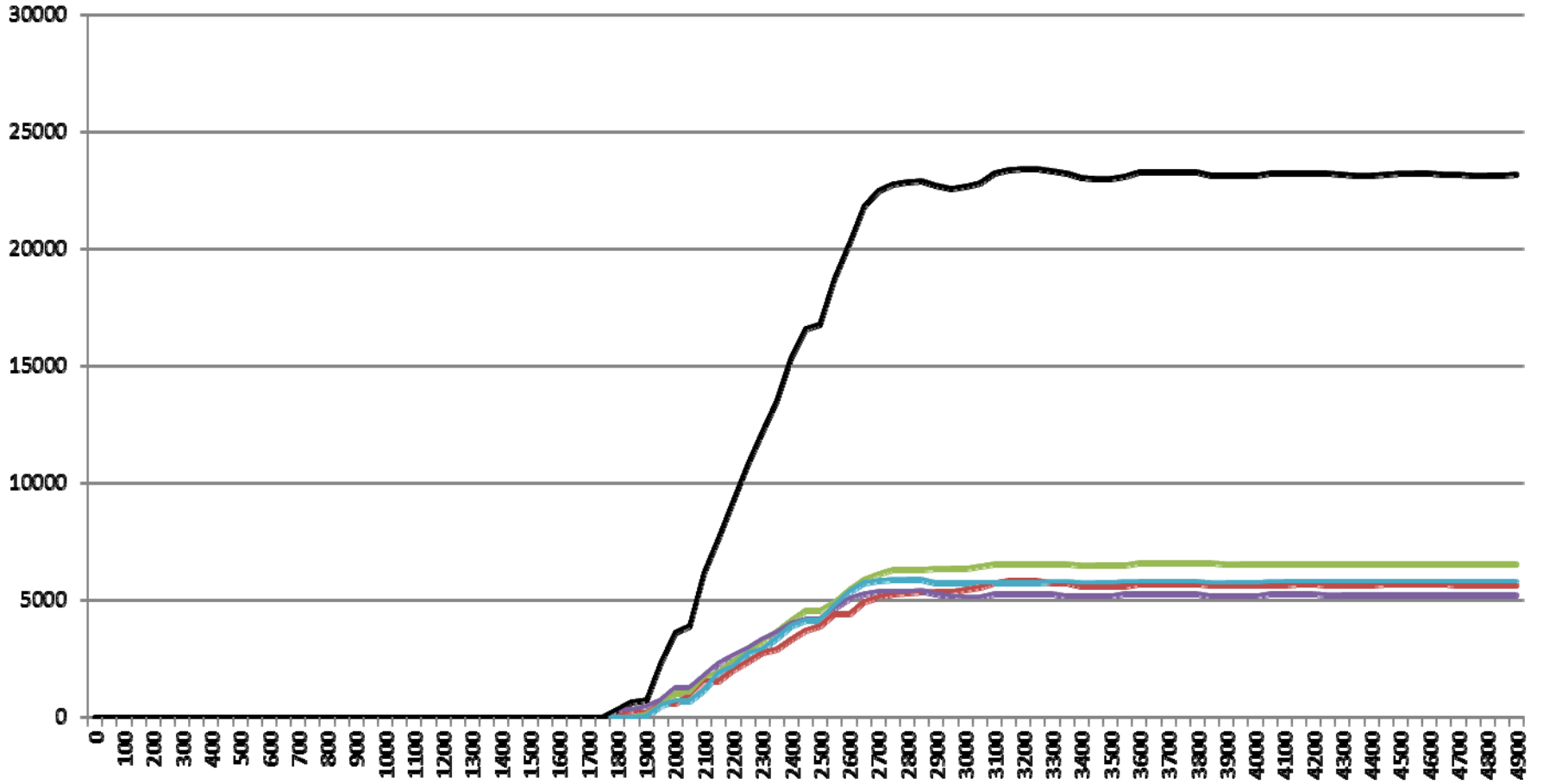
How?

- Weighing is done during the lift cycle
- Dynamic effects accounted for
 - Acceleration and deceleration
 - "Rubber band effects" from the crane wires



BROMMA

A Tradition of Innovation

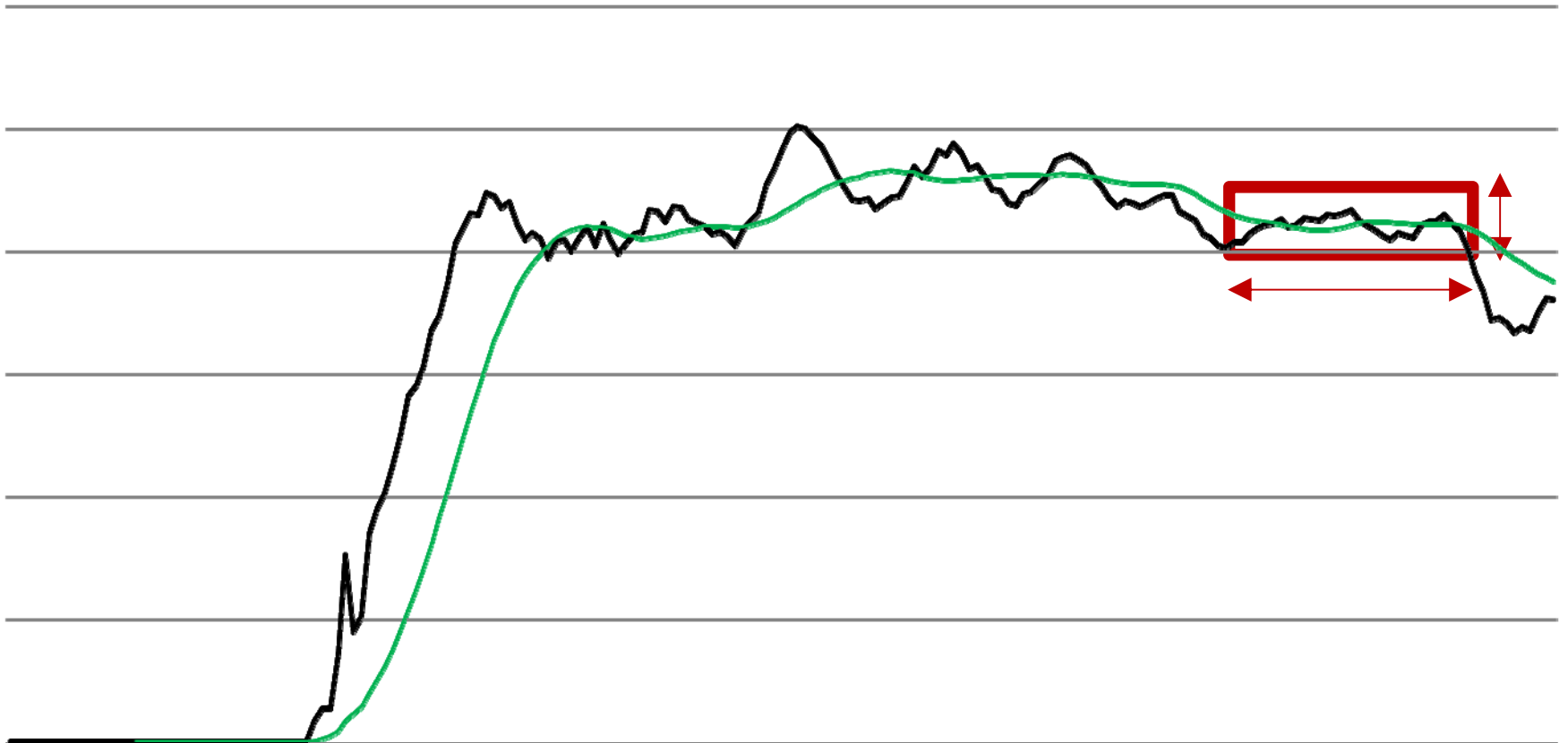


BROMMA

A Tradition of Innovation



Weight



Accuracy



BROMMA

A Tradition of Innovation

National Legislations Apply

- Weighing systems need to be certified and calibrated. No specific requirements are given by IMO. The requirements of each country will apply.
- Accuracy: No details are given. The requirements of each country will apply.

What are we weighing?



Container Weight (in-) Accuracy

- Weighbridge Class IIII
 - Instrument accuracy
 - Vehicle weighed and tared off
 - Kerb weight tared off
- Twistlock Based weighing system
 - System accuracy specification
 - Actual measurement

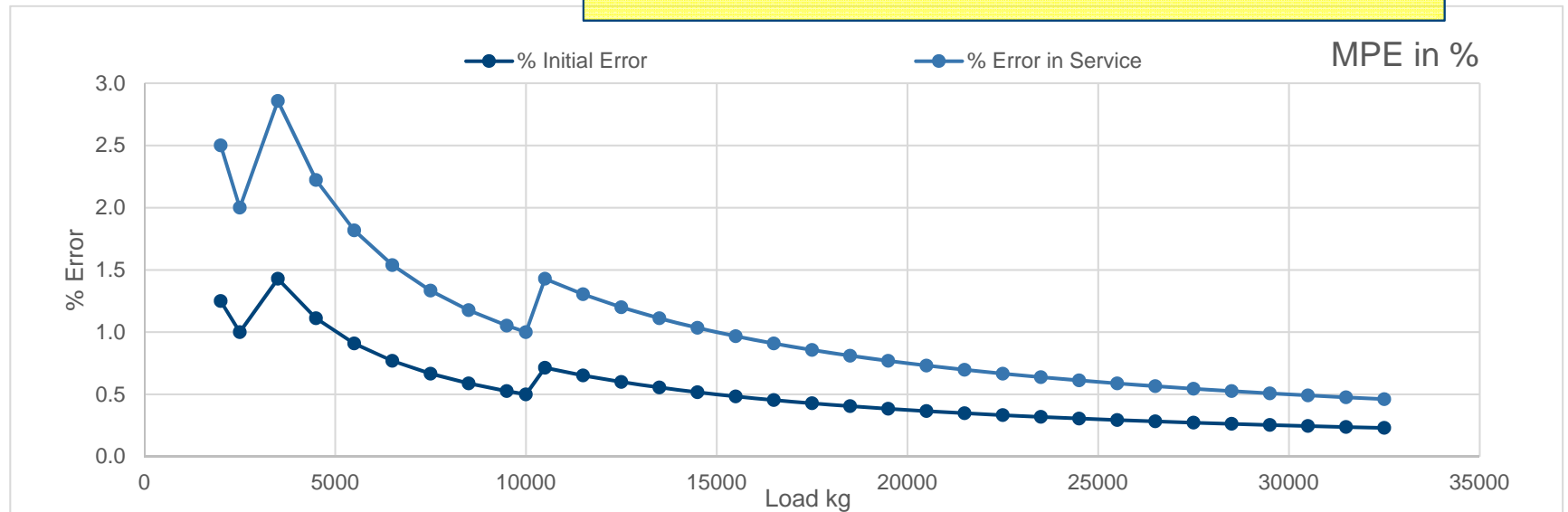
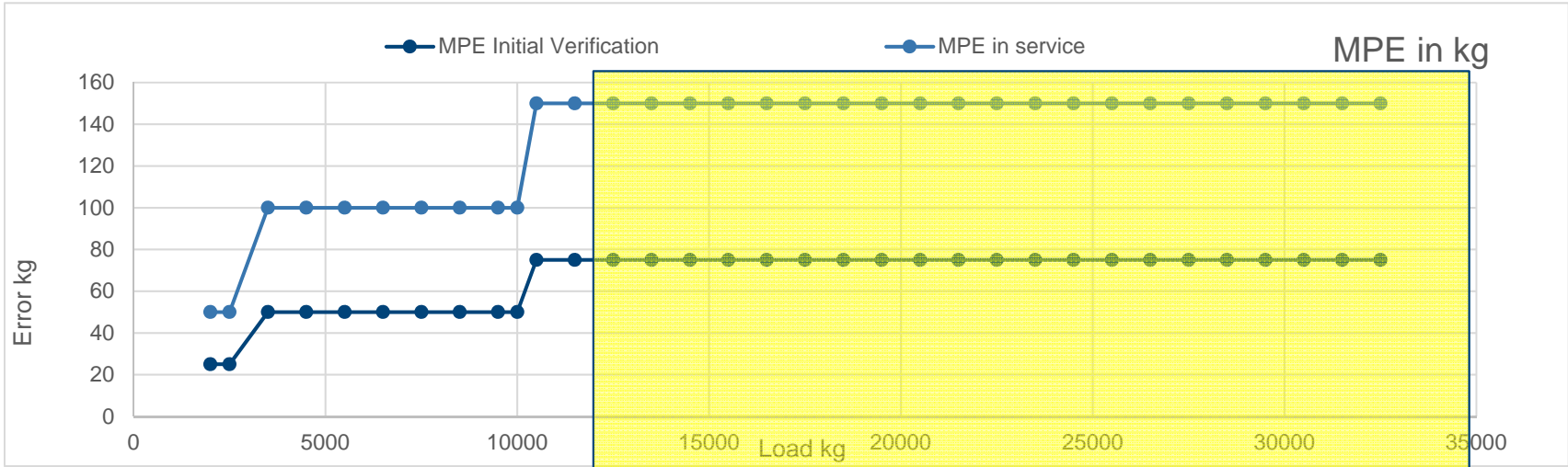


BROMMA

A Tradition of Innovation

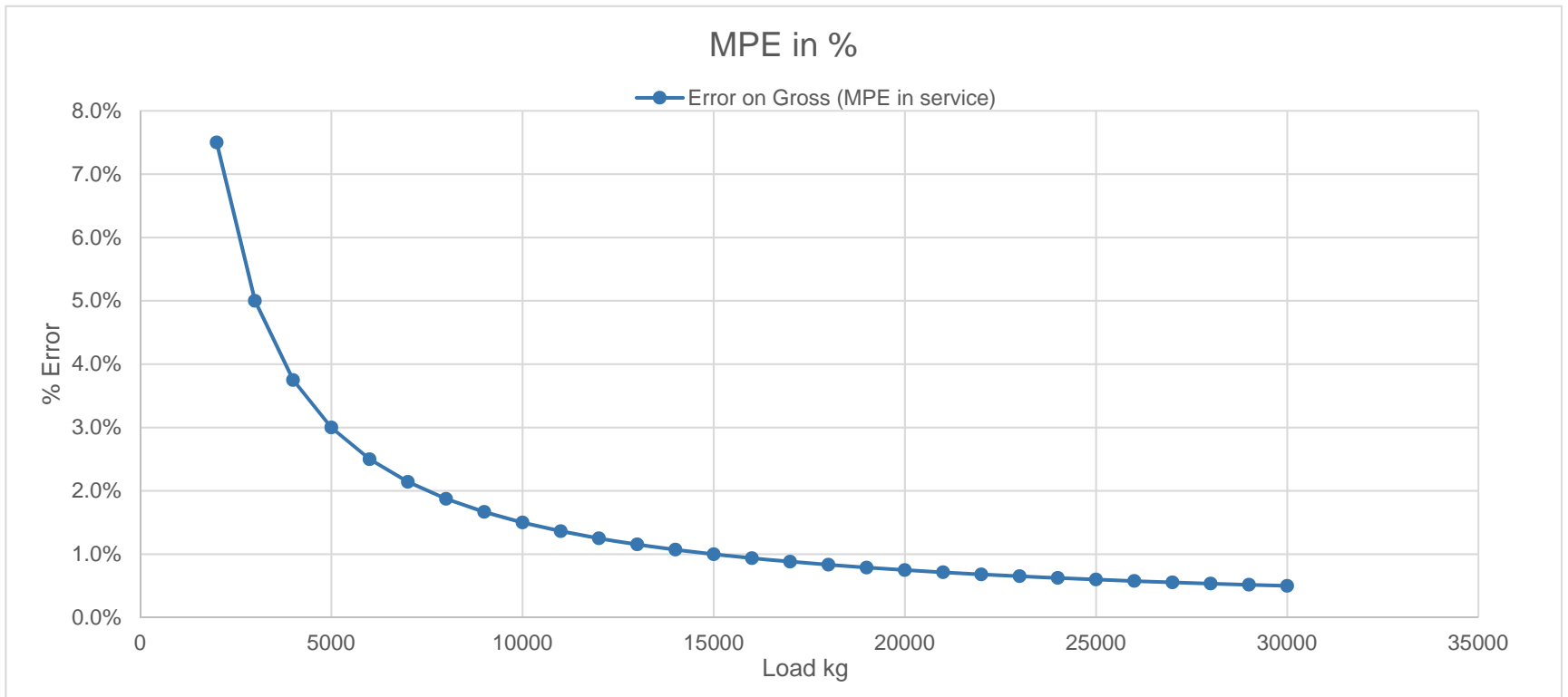
MPE of a Class III Weighbridge

(Verification Scale Interval $e=50\text{kg}$)



MPE of a Class III Weighbridge Based on Container weight

(Verification Scale Interval $e=50\text{kg}$)



Kerb weight (Wikipedia)

Curb weight (US English) or **kerb weight** (UK English) is the total weight of a vehicle with standard equipment, all necessary operating consumables such as motor oil, transmission oil, coolant, air conditioning refrigerant, and a full tank of fuel, while not loaded with either passengers or cargo.

This definition may differ from definitions used by governmental regulatory agencies or other organizations. For example, many European Union manufacturers include the weight of a 75 kilogram driver to follow European Directive 95/48/EC.[1] Organizations may also define curb weight with fixed levels of fuel and other variables to equalize the value for the comparison of different vehicles.

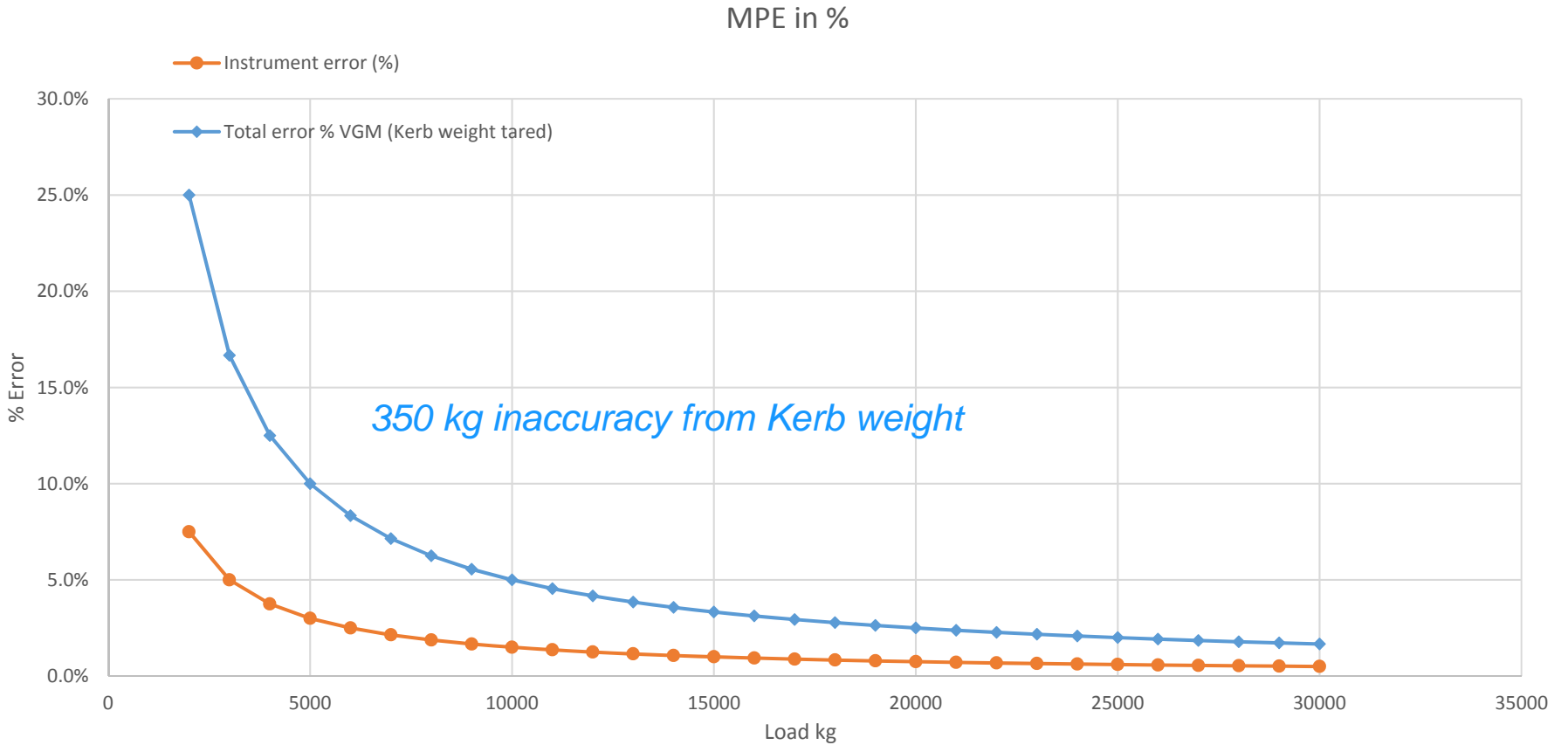
Sources of process inaccuracies



BIONNA

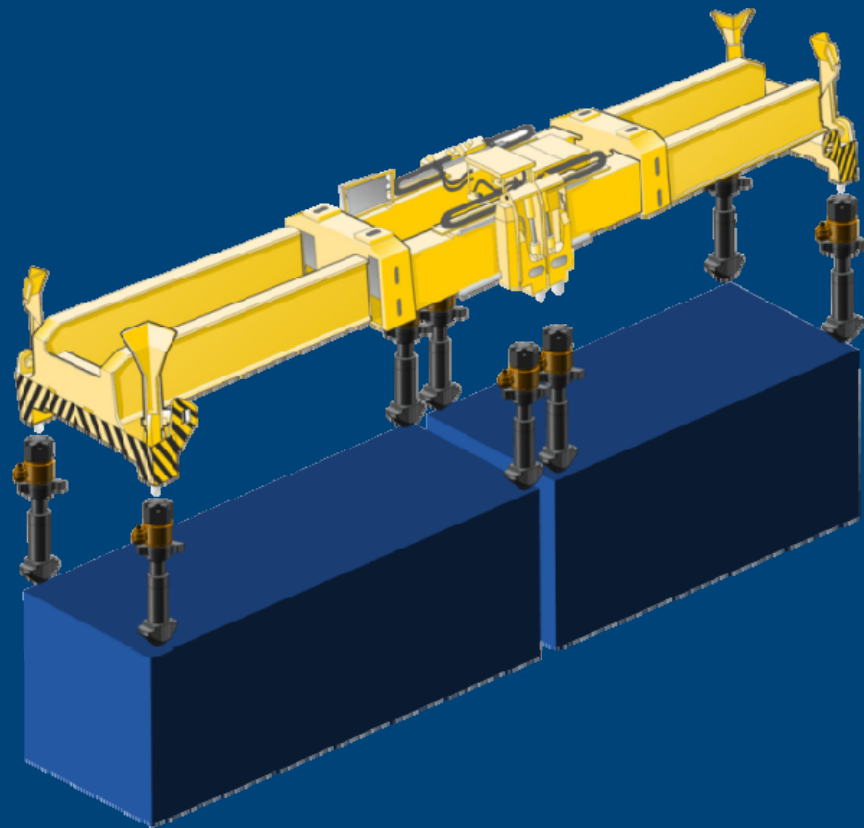
A Tradition of Innovation

Kerb weight based Container weight Accuracy



Bromma TWL Weighing System

- Specification: +- 400 kg
- Certification / Type approval:
 - OIML R51/2006
 - Automatic Catch Weighing Instrument



BROMMA

A Tradition of Innovation

Field Tests by Notified Body

Type of spreader	YSX45E
Lifting platform	40ft flat rack
Test range (kg)	2000-40000
Temperature	4-6 °C
Test standards	OIML R-51 / MID 2014-32-EU
Test weights	UKAS Certified 1-tonne

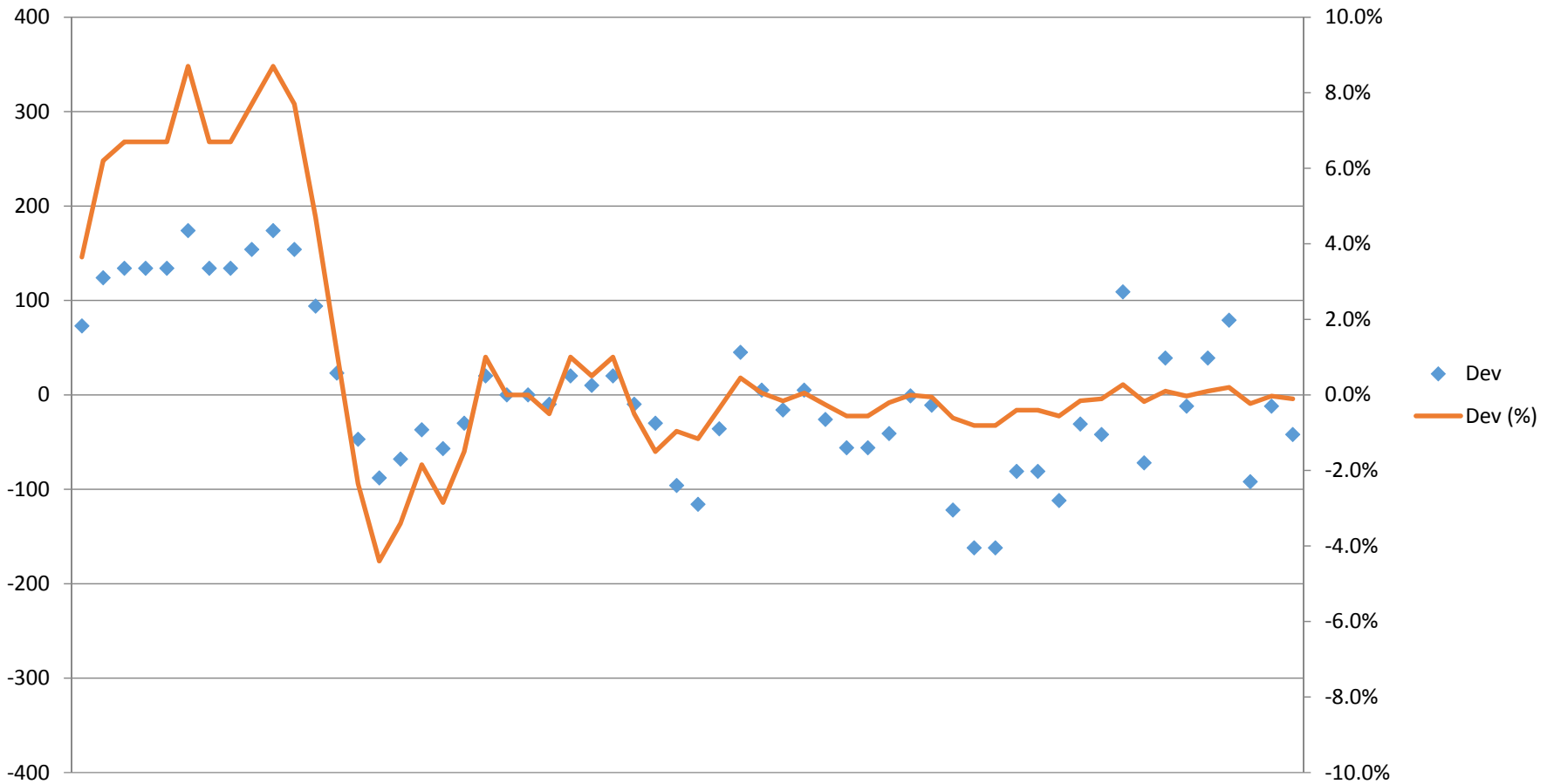


BROMMA

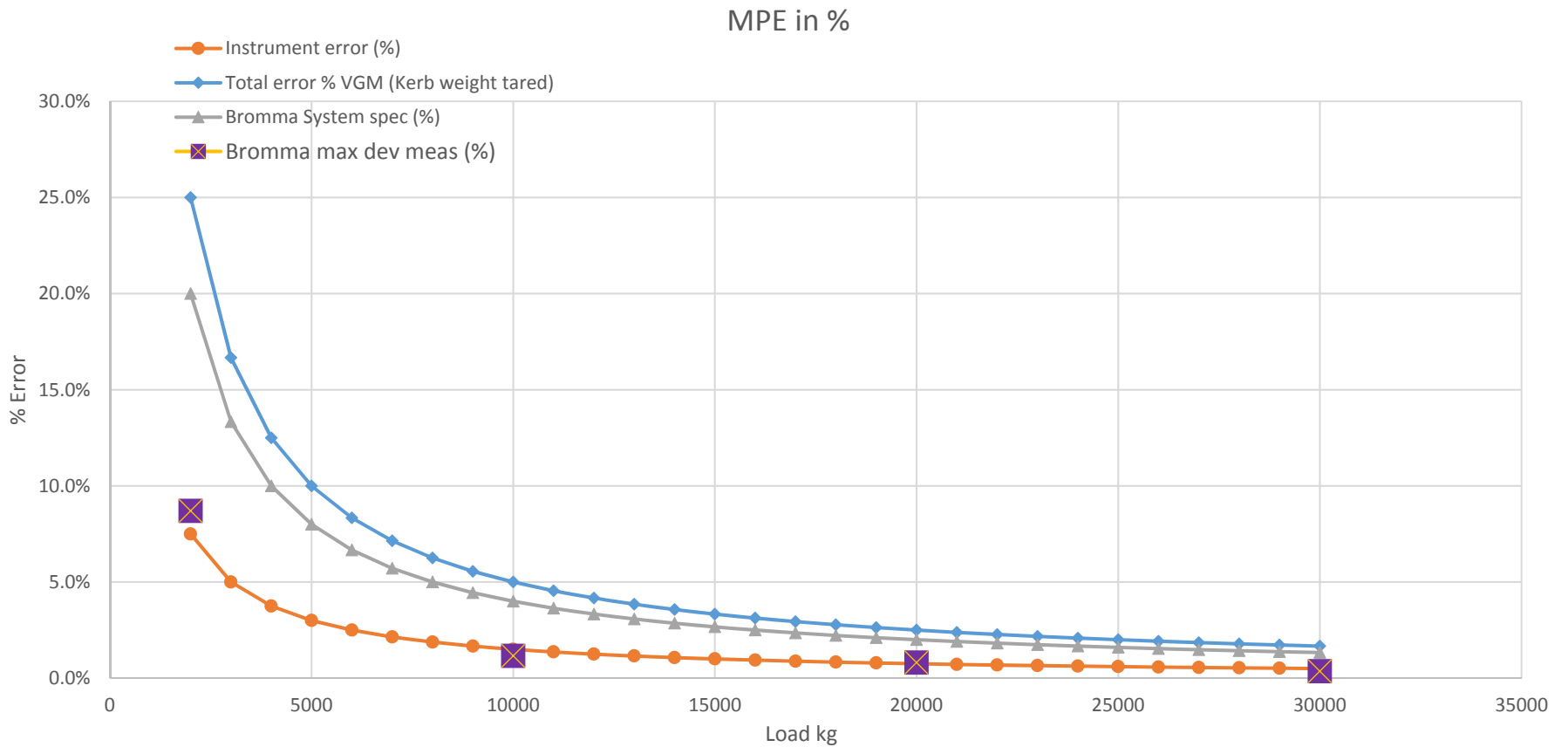
A Tradition of Innovation

Field Test Results

(Deviation from reference weights)



Accuracy - Comparison



Certification

- On July 1, Bromma received OIML R51 certification for the Bromma Container Weighing System as the first system on the market



OIML BASIC CERTIFICATE OF CONFORMITY

OIML Member State
SWEDEN

OIML Certificate N°
R51/2006-SE1-16.01



Applicant

Name: Cargotec CHS PTE LTD BROMMA
Address: 15, Tukang Innovation Drive
Singapore 618299

Issuing authority

Name: SP Technical Research Institute of Sweden
Address: Box 857, SE-501 15 Borås, Sweden
Person responsible: Lennart Aronsson

Manufacturer of the certified pattern is the applicant.

Identification of the certified pattern

A graduated, self-indicating, electronic, automatic weighing instrument.

Type Load Sensing System version 1

Accuracy class Y(b)

Number of verification scale intervals $n \leq 200$

(Identification continued on next page.)

This certificate attests the conformity of the above-mentioned pattern (represented by the samples identified in the associated test report) with the requirements of the following Recommendation(s) of the International Organization of Legal Metrology (OIML):

R51, edition 2006, includes erratum 2010.

This certificate relates only to the metrological and technical characteristics of the pattern of the instrument concerned, as covered by the relevant OIML International Recommendation(s).

This certificate does not bestow any form of legal international approval.

The conformity was established by tests described in the associated test report 6P0240-1 dated 2016-06-28. This is the first issue of this certificate.

Borås, June 28, 2016

SP Technical Research Institute of Sweden Certification


Lennart Aronsson
Product Certification Manager


Bengt Gutfelt
Certification Officer



OIML Certificate of Conformity no R51/2006-SE1-16.01 dated June 28, 2016, page 1 (2)

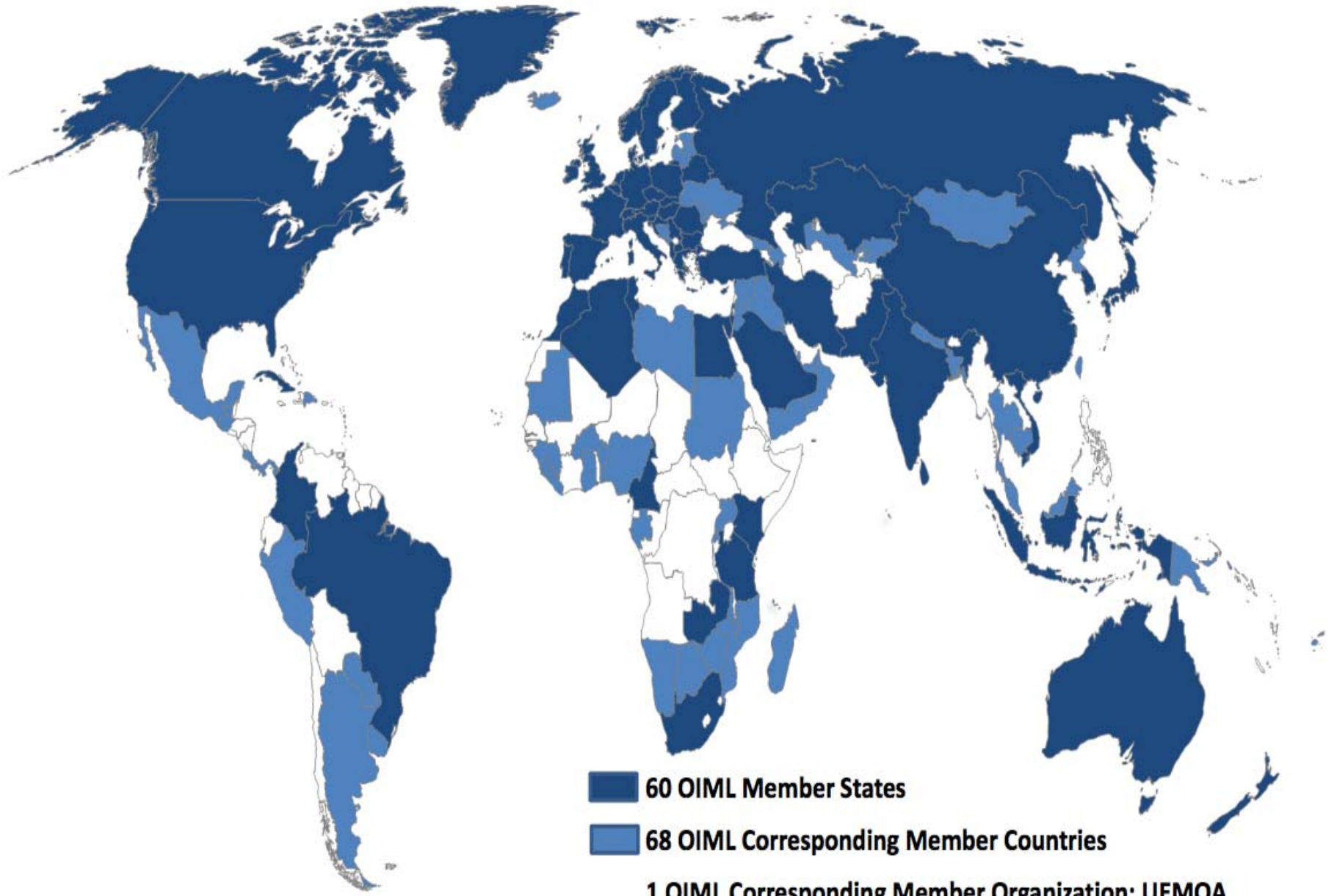
SP Technical Research Institute of Sweden

Box 857, SE-501 15 Borås, Sweden
Phone: +46 10-516 50 00
E-mail/internet: info@sp.se/www.sp.se

SP has been authorised by the Swedish OIML-member to issue and sign OIML-certificates. Important note: Apart from the mention of the certificate's reference number and the name of the OIML Member State in which the certificate was issued, partial quotation of the certificate or of the associated OIML Basic Type Evaluation report is not permitted, though either may be reproduced in full.
SP ref 9C0552-16

BROMMA

A Tradition of Innovation

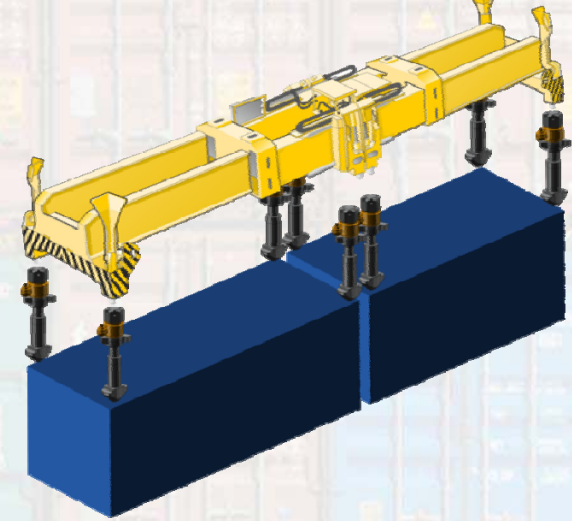


60 OIML Member States

68 OIML Corresponding Member Countries

1 OIML Corresponding Member Organization: UEMOA

Business Case



- Calculation based on 1 MTEU handled
 - 20% 20-footers
- 30% Export containers – potential for weighing
- 20 RTGs needed to handle 1 MTEU
- Investment: 20 systems single lift (retrofit to be on the safe side)
 - Weighing systems: 200 kEuro
 - Other investments: 200 kEuro (eg software)
- Weighing potential over 10 years: 10 x 180 000 containers = 1,8 M containers
- Cost per container: **0.25 USD**

Conclusion

- Awareness about Scale/Instrument accuracy vs Container weight accuracy
 - Process inaccuracies exist
- Twistlock based weighing systems is in some cases as accurate as a weigh bridge
- TWL based systems
 - Non-disruptive to the terminal logistics flow
 - Offers other safety features
 - An interesting business case

A GLOBAL VOICE AND FORUM FOR PORT EQUIPMENT AND TECHNOLOGY

PEMa
PORT EQUIPMENT MANUFACTURERS ASSOCIATION

ABOUT PEMA

MEMBERS

COMMITTEES

MEDIA CENTRE

EVENTS & MEETINGS

PUBLICATIONS

LINKS

PUBLICATIONS

PEMA > Publications

Publications

PEMA IP05 Weighing Containers in Ports and Terminals (1997)

This information paper provides an overview of the technologies available today for the weighing of containers in terminals.

Weighing Containers in Ports and Terminals

A PEMA Information Paper



This Information Paper is intended to provide an overview of the technologies available today for the weighing of containers in terminals. The paper covers both weighbridges and weighing systems for use on ship-to-shore container cranes, mobile harbour cranes, RTGs, RMGs, straddle carriers, reach stackers and container handling fork lift trucks.

The goal is to provide ports, terminals and other interested parties with a clear understanding of the various technologies available today and their relative capabilities.

The document concludes with a table summarising the various technologies and their weighing accuracy.

PEMa
PORT EQUIPMENT MANUFACTURERS ASSOCIATION

www.pema.org

BROMMA

All is well

The Bromma feeling



BROMMA

A Tradition of Innovation