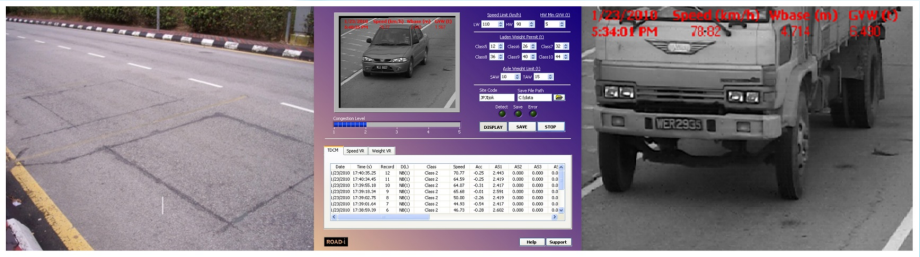
Implementation of Integrated Weigh-in-motion System for Direct and Automated Enforcement of Commercial Vehicle Weight Limits in Malaysia:

A Preliminary Result from Proof-of-concept System

by

Integrated Transportation Solutions Sdn Bhd

Quatriz System Sdn Bhd



PROBLEM DESCRIPTION

Annual pavement cost is escalating every year and Government has to spend hundred of millions or billion annually

RTD recorded 47,569 of overloaded vehicle cases

Posted on 21 December 2015 - 02:27pm
Last updated on 21 December 2015 - 04:30pm
Bernard Cheah
newsdesk@thesundaily.com

KUALA LUMPUR: The Road Transport Department has recorded 47,569 cases of vehicles carrying

"Based on the activities carried out, the cases involving over load weight has increased by 49.9% from 35,437 cases in 2013 to 53,105 cases in 2014," he said in reply to a question by Senator Datuk Khairudin Samad.

"The RTD carry out daily enforcement activities in 50 weighing stations nationwide.

"Based on the activities carried out, the cases involving over load weight has increased by 49.9% from 35,437 cases in 2013 to 53,105 cases in 2014," he said in reply to a question by Senator Datuk Khairudin Samad.

Meanwhile, the Land Public Transport Commission (SPAD) and the Road Transport Department (JPJ) have penalised lorries overloaded by up to 138% since early this year.

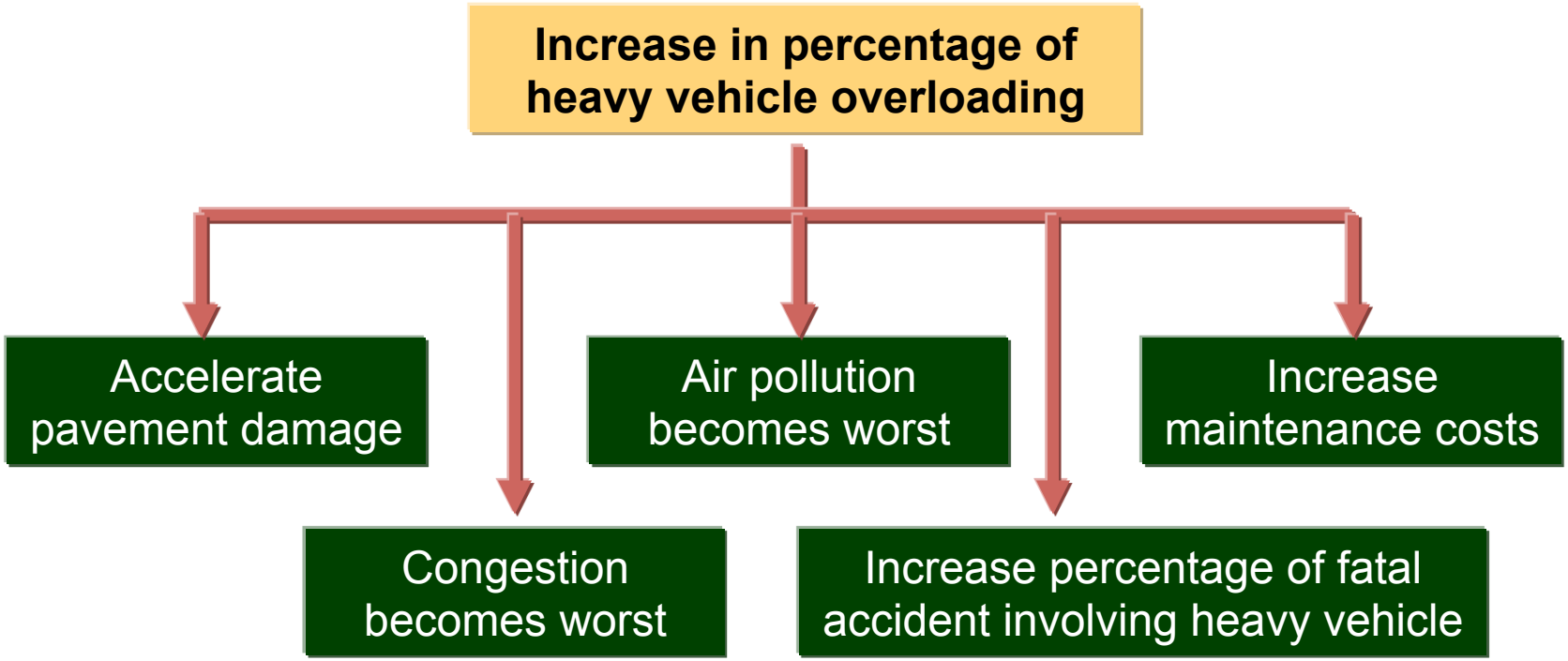
Statistics provided by the authorities also showed that about 70% of these lorries carried more than half above the permitted load.

"Overloading has become a common practice among lorry operators.

"If we do not act against them, everyone will overload just to compete with one another," said SPAD chief executive officer Mohd Nur Ismal Mohamed Kamal.

PROBLEM DESCRIPTION

In summary….



This situation is mainly due to limitations in monitoring and enforcement of overloaded truck activities

OBJECTIVE

- To implementation a **Proof-of-concept (PoC) Weigh-in-motion (WIM) System** at selected location in Malaysia
- To evaluate and investigate the **effectiveness of WIM system as an alternative method** for direct and automated related to vehicle overloading
- To **quantify the overloading problem in Malaysia** based on data collected from WIM PoC system

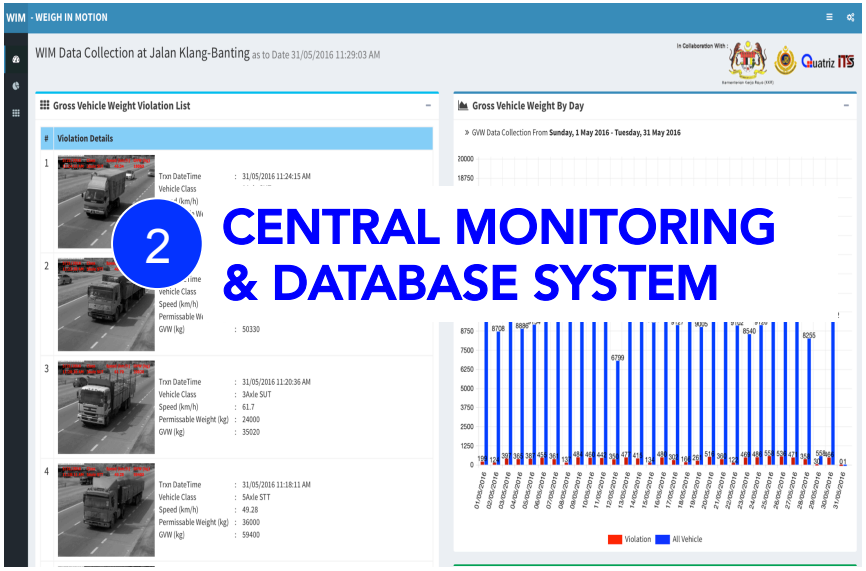
METHODOLOGY

- **Proposal to Ministry of Works (MoW)** for the implementation of WIM PoC at two (2) selected location in Malaysia by Quatriz-ITS
- **Approval from MoW and the formation of a Technical Steering Committee** at the National Level comprises of various agencies and led by Highway Planning Division to evaluate the implementation of WIM PoC system
- **Identification of site** for the installation of WIM PoC system
- **Procurement process** and instruments preparation
- **Installation of WIM PoC** and initial calibration
- **Commissioning of WIM PoC system**
- **Data-collection and monitoring process**
- **SIRIM verification and calibration certification test**
- **Completion of the implementation of WIM PoC system**

OUR PROPOSED SYSTEM

OVERALL CONCEPT

DIRECT WEIGH-IN-MOTION (WIM) ENFORCEMENT



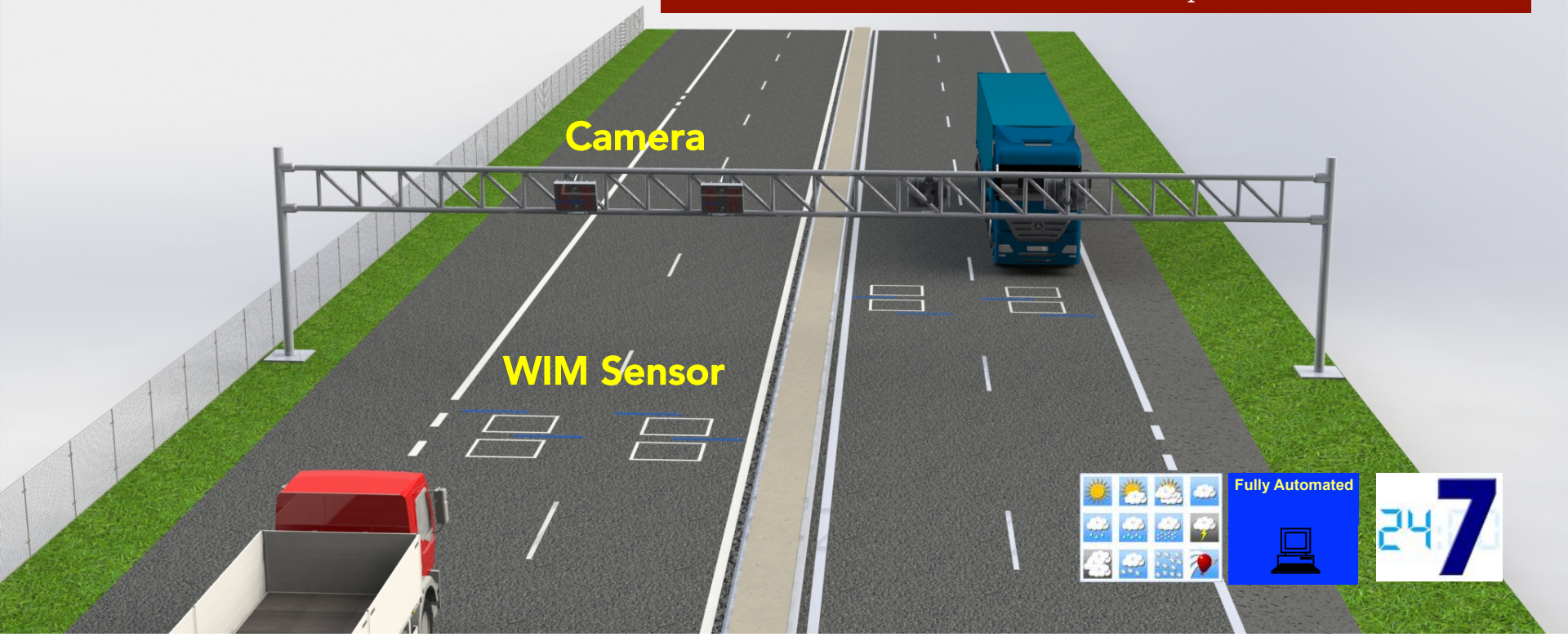
OUR PROPOSED SYSTEM

ON-SITE SYSTEM

-DIRECT WEIGH-IN-MOTION (WIM) ENFORCEMENT-

1 ON SITE SYSTEM

The system is able to weigh a vehicle while in motion automatically and continuously in real-time. Therefore, it can provide accurate vehicle weight information to enforcement station for effective and efficient enforcement implementation.



OUR PROPOSED SYSTEM

-DIRECT WEIGH-IN-MOTION (WIM) ENFORCEMENT-

WIM - WEIGH IN MOTION

WIM Data Collection at Jalan Klang-Banting as to Date 31/05/2016 11:29:03 AM

In Collaboration With : Kementerian Kerja Raya (KKR) Quatriz ITS

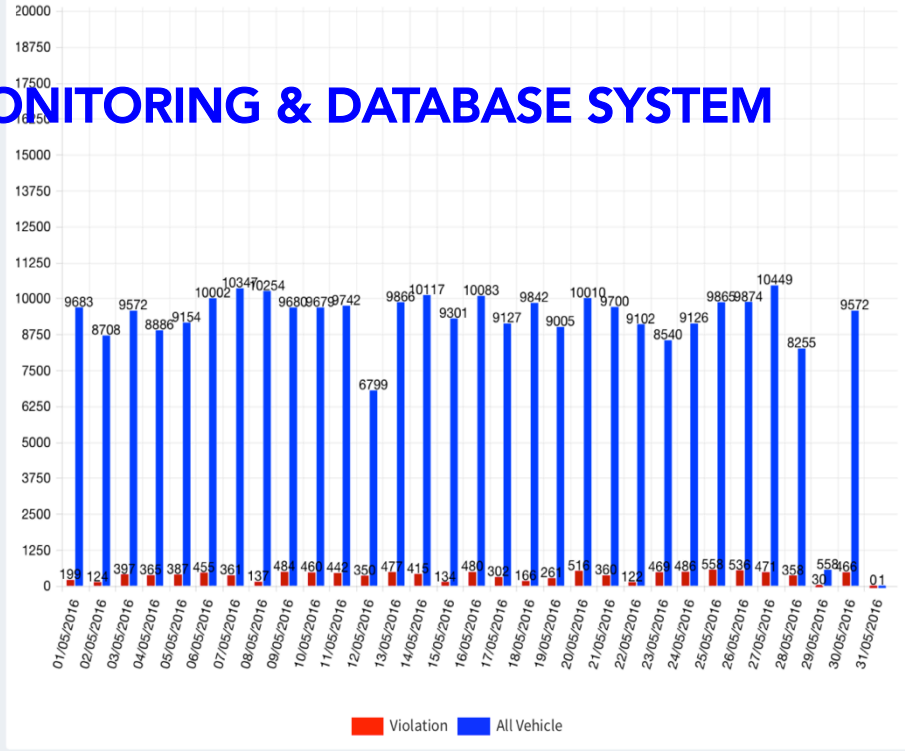
Gross Vehicle Weight Violation List

#	Violation Details	
1		Trxn DateTime : 31/05/2016 11:24:15 AM Vehicle Class : 2Axle SUT Speed (km/h) : 45.34 Permissable Weight (kg) : 16000 GVW (kg) : 18060
2		Trxn DateTime : 31/05/2016 11:22:29 AM Vehicle Class : 5Axle STT Speed (km/h) : 48.11 Permissable Weight (kg) : 36000 GVW (kg) : 50330
3		Trxn DateTime : 31/05/2016 11:20:36 AM Vehicle Class : 3Axle SUT Speed (km/h) : 61.7 Permissable Weight (kg) : 24000 GVW (kg) : 35020
4		Trxn DateTime : 31/05/2016 11:18:11 AM Vehicle Class : 5Axle STT Speed (km/h) : 49.28 Permissable Weight (kg) : 36000 GVW (kg) : 59400

2 CENTRAL MONITORING & DATABASE SYSTEM

Gross Vehicle Weight By Day

» GVW Data Collection From **Sunday, 1 May 2016 - Tuesday, 31 May 2016**



OUR PROPOSED SYSTEM

Integrated Weigh-in-motion (WIM)

1 ON SITE SYSTEM

In short….weigh various types of vehicle while in motion at any speed accurately and automatically

WIM Software

Multi-parameters

- Date & Time
- Counting
- No. of Axle
- Lane & Direction
- Speed
- Acceleration
- Wheelbase
- Classification
- Axle Spacing
- Axle Weight
- Gross Vehicle Weight
- Volume
- Time Headway
- Gap Distance

Continuous measurement
24 hours 7 days

All weather conditions

OUR PROPOSED SYSTEM

1 ON SITE SYSTEM

WIM Sensor Technology

- Quartz Piezo

- PVDF Piezo

- Strain gauge based sensor
  - Bending Plate

  - Load Cell

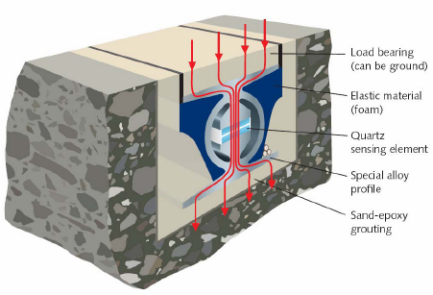
- Quartz Piezo
  - Insensitive to temperature and climate changes
  - Accurate for low and high speed
  - Can be used to obtain all vehicle and traffic parameters (need to develop customized software)
  - Robust to all weather conditions
  - Easy installation
- Bending Plate
  - Sensitive to temperature
  - Accuracy deteriorates at high speed
  - Very sensitive to lightning
  - Need to integrate with other devices to obtain more than weight parameter

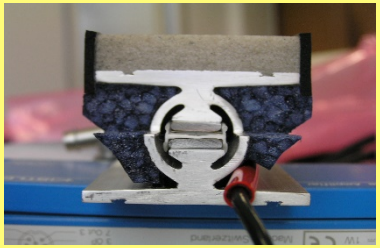
OUR PROPOSED SYSTEM

1 ON SITE SYSTEM

Quartz sensor was selected as a main sensor to produce traffic and vehicular data

Quartz Sensor





- Sensitive to vertical force only

(no ghost axle, no lost of information)

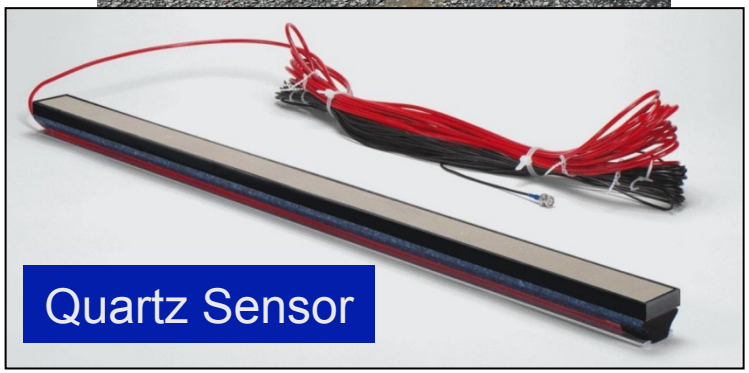
- Stable properties with temperature

(no compensation needed)

- Insensitive to temp., & pavement characteristics

(No recalibration needed)

- No electromagnetic interference
- Robust to lightning



OUR PROPOSED SYSTEM

1 ON SITE SYSTEM

WIM Sensor Installation…

OUR PROPOSED SYSTEM

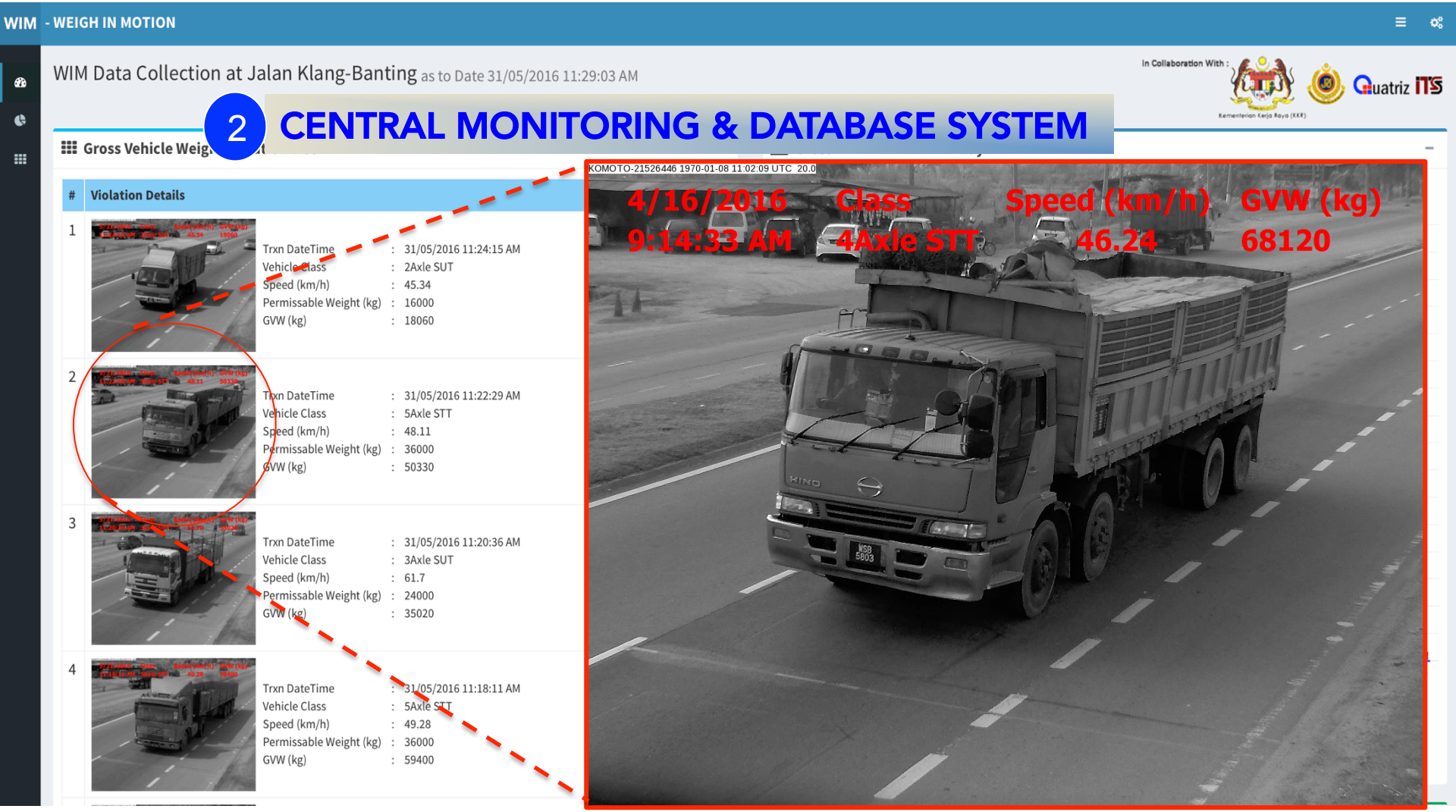
1 ON SITE SYSTEM

Calibration & Certification…

NML-SIRIM (**National Metrology Laboratory)**

OUR PROPOSED SYSTEM

-DIRECT WEIGH-IN-MOTION (WIM) ENFORCEMENT-



OUR PROPOSED SYSTEM

EXAMPLE OF CAPTURED IMAGE

OUR PROPOSED SYSTEM

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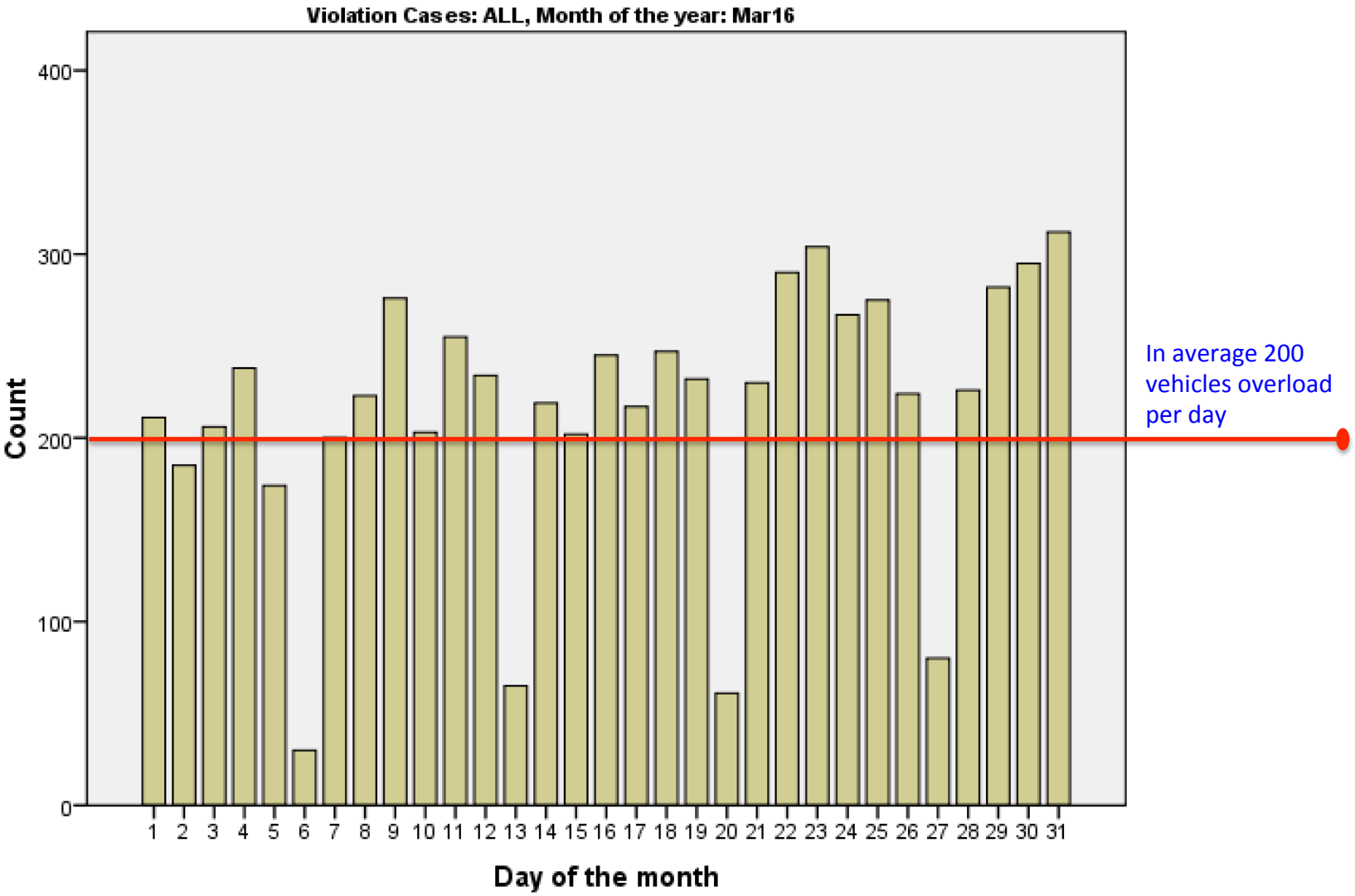
OUR PROPOSED SYSTEM

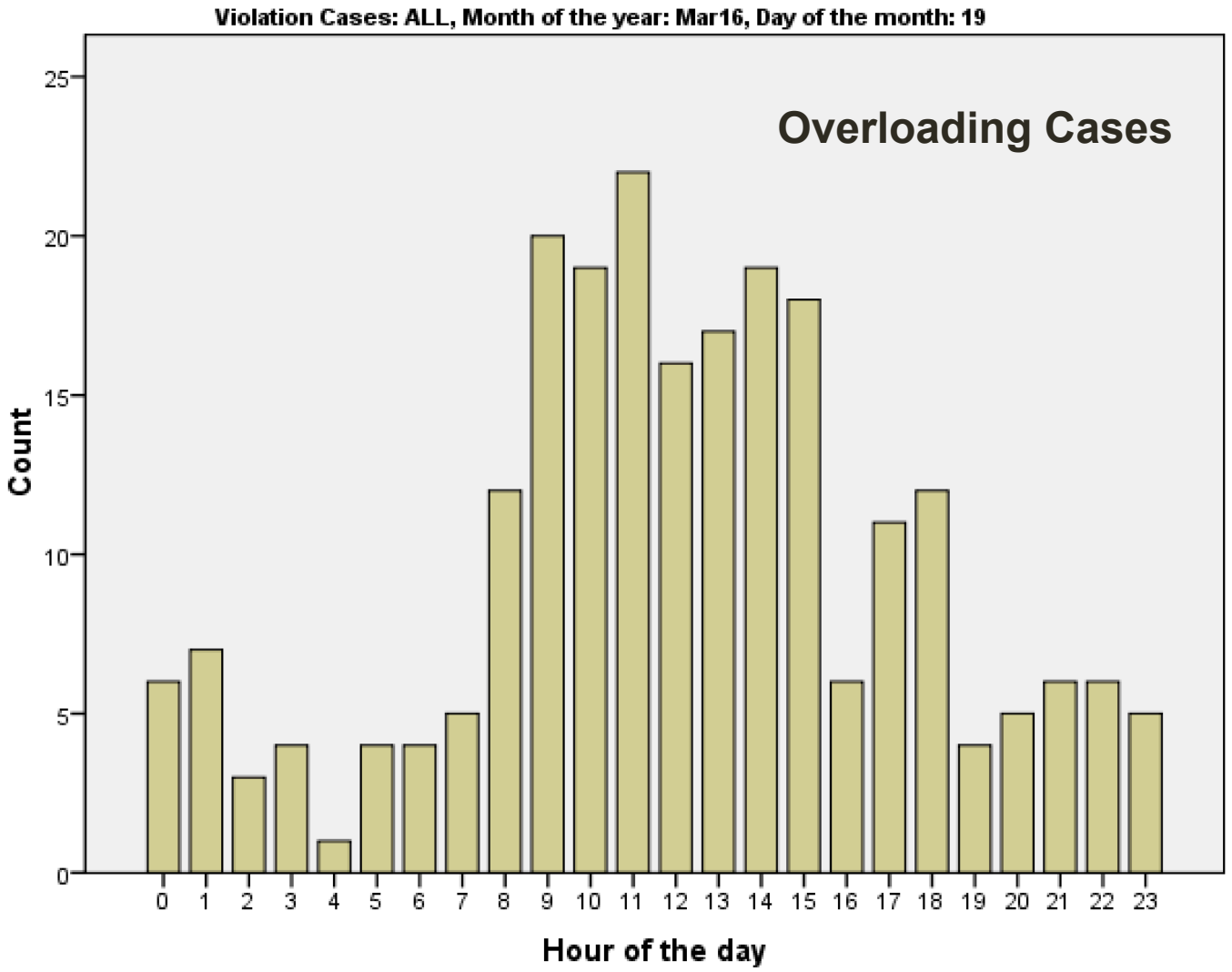
Statistics

Overloading Cases (March 2016, KM9 Jalan Klang-Banting)



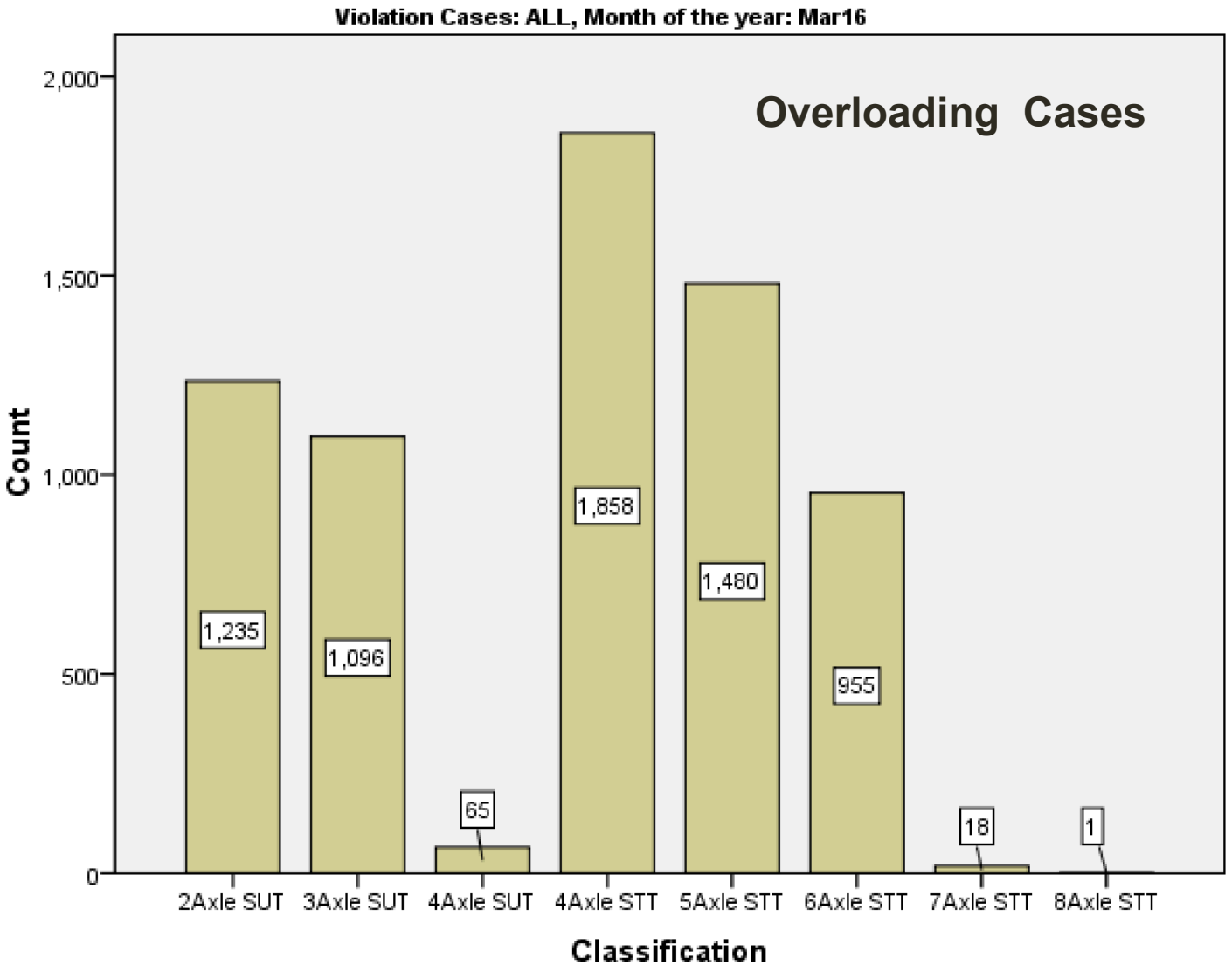
OUR PROPOSED SYSTEM

Statistics



OUR PROPOSED SYSTEM

Statistics



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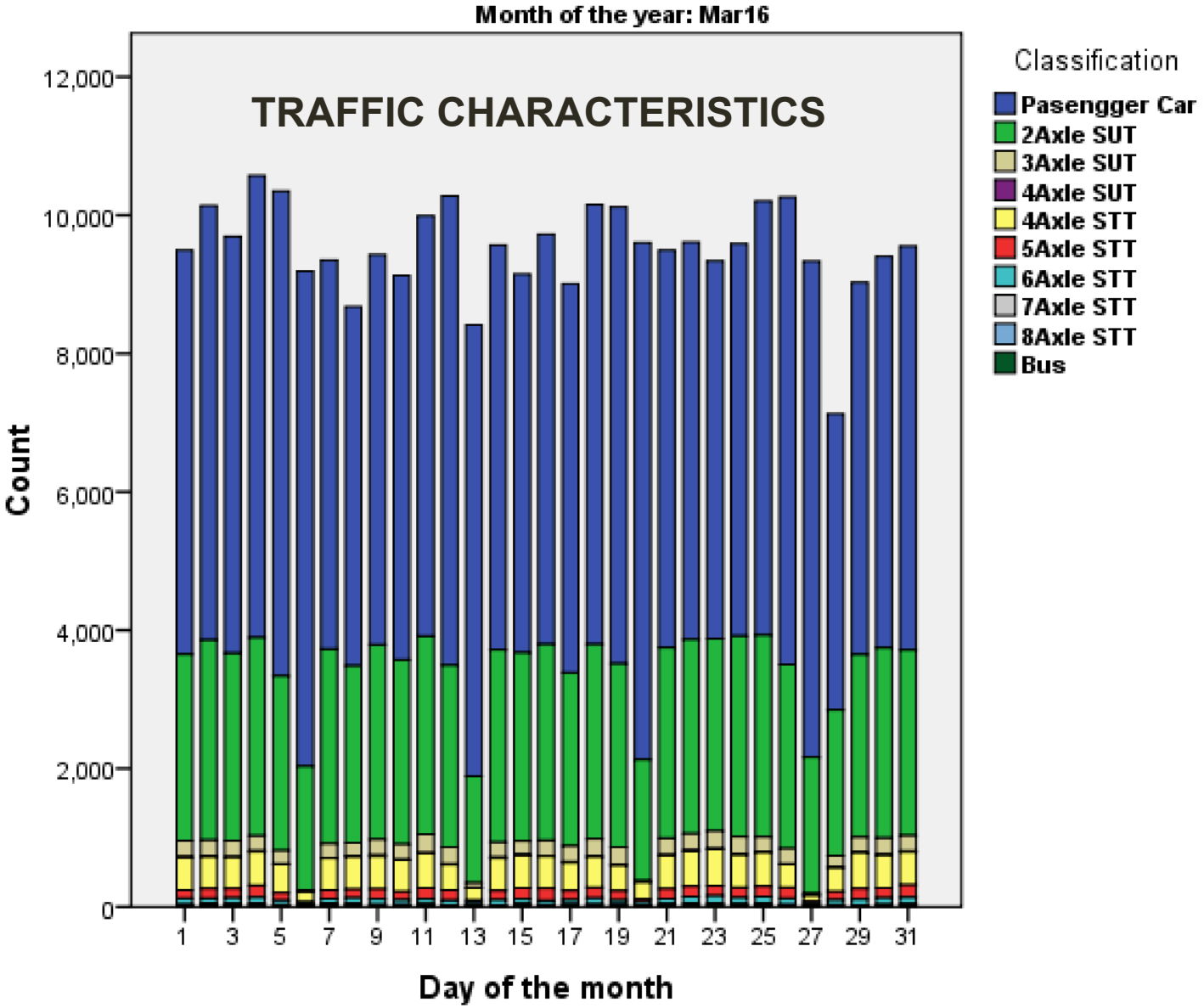
Statistics



OUR PROPOSED SYSTEM

Standard Compliance

WIM Sensor compliance with OIML R-134 Standard

Media Release

First WIM System to Obtain OIML Certification

Kistler Lineas® strip sensors are now OIML-certified for low to medium-speed vehicle weighing

Winterthur, April 15, 2015 – Kistler is announcing that it has obtained the OIML R-134 certificate for its Weigh-In-Motion (WIM) system consisting of Lineas quartz WIM sensors and the Kistler WIM Data Logger. Kistler is the first WIM manufacturer to have received an OIML certificate for vehicle weighing with strip sensors from 3 to 65 km/h. As OIML R-134 is the international metrology standard for legal weighing applications, the certificate paves the way for the use of Kistler WIM systems in applications such as weight-based toll collection and automatic weight enforcement. Road concessionaries and toll road operators can upgrade existing manual toll collection solutions to free-flow automatic toll collection, allowing vehicles to pass their toll collection sites without stopping. Furthermore, governments in several countries are pushing ahead with automatic weight enforcement applications. OIML provides a sound basis for creating the necessary legal framework for these applications. Kistler's OIML-certified, maintenance-free WIM systems are based on extremely durable quartz crystal sensors and can be integrated into any manual or automated weighing system.

Need for Legal Weighing Applications

For many years now, WIM systems have served as 'preselection tools' for weight enforcement and have delivered valuable traffic data. However, traditional WIM systems are not allowed to be used for legal weighing applications such as weight-based toll collection and automatic weight enforcement. As more and more road concessionaries and toll road operators wish to perform financial transactions (tolling) and governments push to implement automatic enforcement applications based on vehicle weight data, there has been an increasing demand for certified WIM systems, accredited according to international standards. Kistler is the first WIM manufacturer to have received the OIML R-134 certificate for vehicle weighing with strip sensors from 3 to 65 km/h. This certificate states that Kistler WIM systems based on maintenance-free Lineas® quartz WIM sensors and the Kistler WIM Data Logger can be used for legal weighing applications.

SIRIM Measurement & Calibration Certificate

SIRIM

Calibration Report

Job No.	:	160736
Report No.	:	NML/1795/M/16
Calibration Date	:	05 May 2016
Issue Date	:	13 May 2016
Page	:	2 of 4

Issued to	:	**QUATRIZ SYSTEM SDN. BHD.**, 4th Floor, AlloyMTD Building, No. 1, Jalan Batu Caves, 68100 Batu Caves, Selangor
Job No.	:	160736
Date of calibration	:	05 May 2016
Calibration Instrument		
Name of Instrument	:	ROAD-i Integrated Weigh-in-motion System
Readability	:	10 kg
Model No.	:	IWIM1215FT5
Location	:	Stesyen Penguatkuasa JPJ, (Jambatan Timbang) KM 9,Jalan Klang-Banting (Jalan Langat), 42100 Klang, Selangor
Environment Conditions		
Ambient Temperature	:	(36.8 to 40.2) °C
Humidity	:	(50.1 to 55.2) % relative humidity
Calibration Procedure	:	The ROAD-i Integrated Weigh-in-motion System was tested with calibrated standard weights and calibrated vehicles (3 axles). The tests carried out were repeatability and weighing performance.
Unc		

- (WIM PoC) Mean Error Rate GVW is 1.27%
- ASTM 1318-02 Standard Type III for Enforcement is ±6%

OUR PROPOSED SYSTEM

System Benefit

Fully Automated

Quality Historical Data
Comprehensive Monitoring & Enforcement
Continuous Monitoring & Enforcement

Thank You

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