ISWIM

Southern African Transport Conference

David Alumasa, CAMEA

Effective Use of WIM Direct Enforcement (WDE)

Long-Term WIM Experience

850+
LANES

WEIGH-IN-MOTION

200+
LANES

WIM DIRECT ENFORCEMENT

1,550+
LANES

ITS WORLDWIDE

80+
LANES

WIM IN AFRICA

Long-Term Experience with WDE

200+ LANES

Most stations worldwide

2011

1st type approval in the world in CZ

2013

Type approval in RU

2021

Type approval in UA

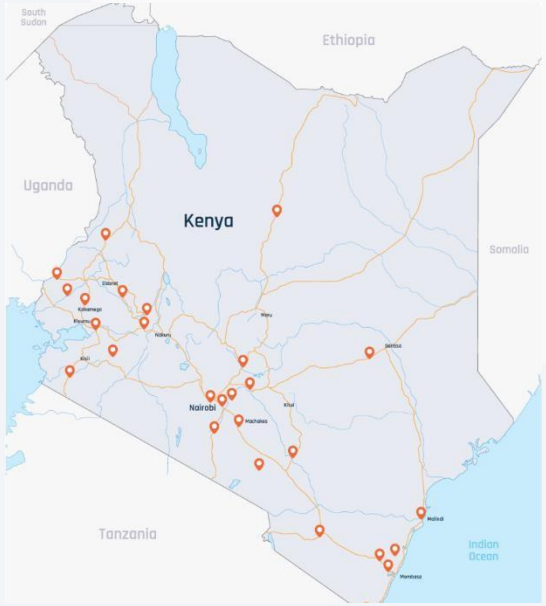
2023

WIM OIML R-134

Type approval in KE

WIM References in East Africa

- 30+ stations used for various purposes
  - Pre-selection for static scales
  - Data collection for WIM statistics
  - Monitoring in a single data center



"We are pleased to report the observed reality on Kenyan National roads. Queues at the static weigh stations are significantly shorter, compared to before implementing the Weigh-In-Motion. The Weigh-In-Motion solution, both at the static and virtual weigh stations, helps reduce overloading, facilitate trade, and protects both infrastructure and people in the long run."

ENG. MUITA NGATIA, DEPUTY DIRECTOR,
ROAD ASSET MANAGEMENT, 2020
Kenya National Highway Authority (KeNHA)

Example - Axle Loading Limits in East Africa

The East African Community Vehicle Load Control Act, 2016 outlines axle load limits of any vehicle using the Regional Trunk Road Network (source: KeNHA)

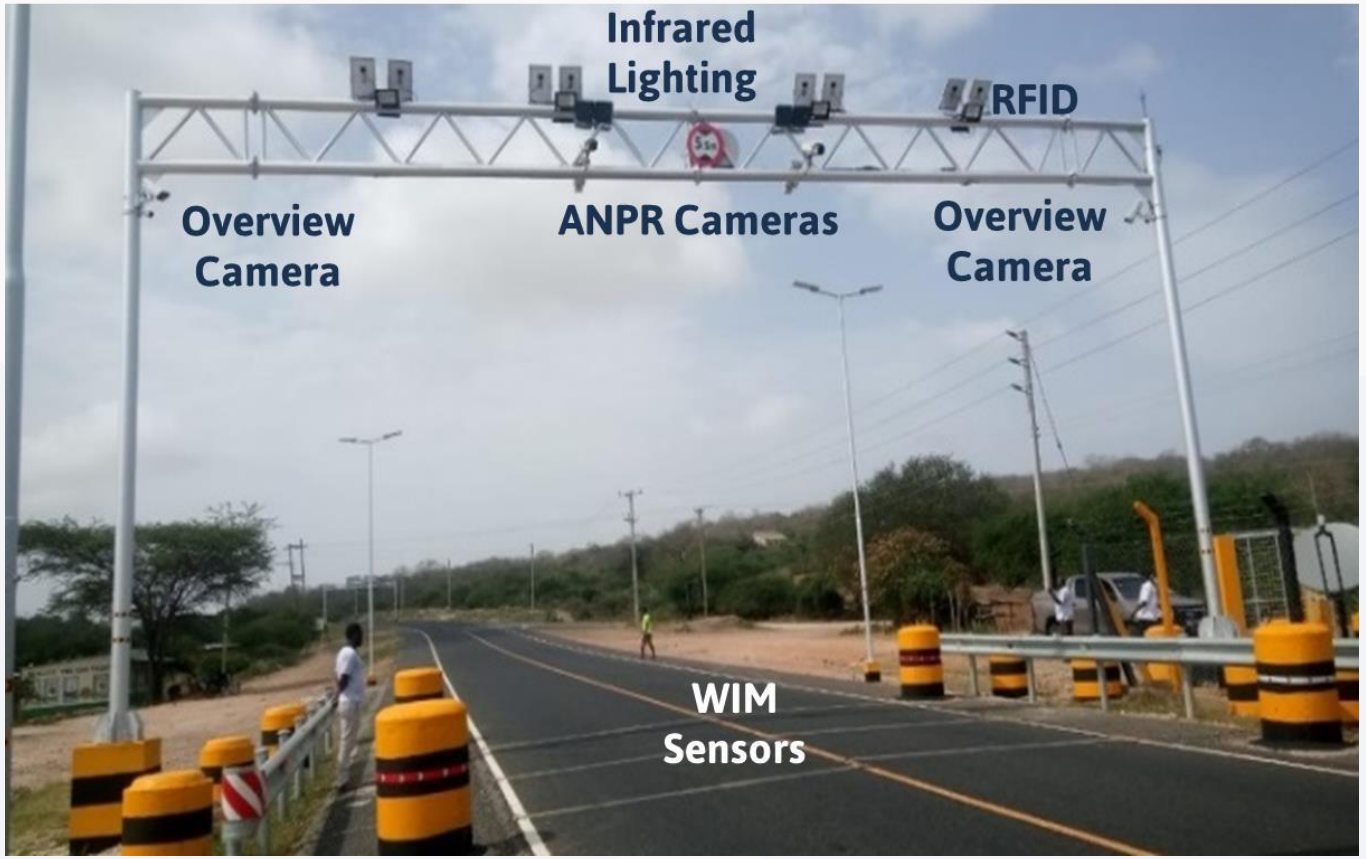
Axle Type	Number of Tires on Axle	Type of Tire	Permissible Limit [t]
Single	2	Conventional	8
Single	4	Conventional	10
Tandem	8	Conventional	18
	4	Super Single	16
Tandem	12	Conventional	24
	6	Super Single	22.5
Liftable Single	4	Conventional	10
Liftable Single	2	Super Single	8.5

Example - Overload Charges in Kenya

Overloading fees schedule for maximum GVW, fines increase progressively with overload (source: KeNHA, Overload Charges 2021 - 2030)

Up to [kg]	Fee [USD]	Up to [kg]	Fee [USD]	Up to [kg]	Fee [USD]	Up to [kg]	Fee [USD]
500	235.90	…	…	…	…	…	…
1,000	482.50	9,000	6,979.95	22,000	64,942.55	28,500	218,523.10
1,500	750.55	9,500	7,634.00	22,500	71,064.75	29,000	240,685.25
2,000	1,018.60	10,000	8,352.35	23,000	77,819.55	29,500	265,206.25
2,500	1,308.05	10,500	9,113.60	23,500	85,260.55	30,000	292,321.95
3,000	1,608.30	11,000	9,928.50	24,000	93,452.10	30,500	322,321.85
3,500	1,929.95	11,500	10,818.40	24,500	102,501.40	31,000	355,516.85
4,000	2,262.30	…	…	…	…	31,500+	375,266.60

Typical WIM Station



Worldwide Experience with WDE 1/2

Road Quality is the Most Important Parameter for Accuracy

- It must be guaranteed throughout the entire service life of the system
- Or if the quality worsens, the site must be recalibrated to a lower accuracy
- Vehicle vibrations on bad roads can affect up to 50 % of measurements

Drivers Avoid Weighing Not to Pay Fines

- Speed changes and maneuvers affect up to 30 % of measurements (braking, acceleration, changing lanes, driving closely behind each other)
- Some maneuvers can also be unintentional (drivers' habits, unmarked WIM station, placement of sensors in the traffic lane limited by joints between concrete blocks, road shoulder)

Worldwide Experience with WDE 2/2

Diverting to Other Roads to Bypass WIM

- Drivers use alternate routes to avoid weighing
- This causes overloading on these roads
- Equipping all roads with the most accurate stations would be costly

The Best Solution is a Combination with Other ITS

- Improvement of traffic safety
- Increase of the system's utility value
- Potential increase in revenue collection

Ways to Address Road Quality

Following Standards and Recommendations

- When selecting a WIM site, the criteria for road quality must be followed:
  - Road surface conditions
  - Used materials
  - Pavement thickness
  - Transverse and longitudinal slope
  - Curvature
  - No rutting or cracking is acceptable
- E.g., COST323 Class "I Excellent" required for 5% gross weight accuracy (WIM direct enforcement)

Ways to Address Weighing Avoidance

Legal Measures

- Marking the WIM station - the law forbids any maneuvers
- The license plates must be visible to ensure the identification
- Thanks to the detection and documentation by the WIM system, the maneuvers can be fined as avoiding the weight measurement (the fine can be even higher than for overloading)

Ways to Address Weighing Avoidance

Speed Limits

- WIM Enforcement: Ensuring the vehicles drive fluently without any speed changes
- Bonus Features:
  - Safer traffic, less noise and cleaner air
  - Increased revenue collection - passenger cars are typically not overloaded but tend to speed
  - By enforcing limits, the number of speeding drivers is typically reduced by around 80 % within a few months
- Solution: Combination with spot and average speed enforcement

Speed limits for fluency

Ways to Address Weighing Avoidance

No Maneuvers Allowed

- WIM Enforcement: Proper documentation of maneuvers and validity flags for records
- Bonus Features:
  - Further validation possible by operators
  - Additional information available
- Solution: Using overview cameras to record the maneuvers and advanced validation algorithms to flag records as (in)valid

ATTENTION! WEIGHT CONTROL. DRIVE WITHOUT ACCELERATION OR BRAKING.

Ways to Address Weighing Avoidance

Forcing Distance between Vehicles

- WIM Enforcement: Separation of drivers trying to driver closely together
- Bonus Features:
  - Dimension measurement for infrastructure protection
  - Traffic safety improvement by excluding oversized vehicles from the traffic flow
  - Additional classification information and 3D models of the vehicles
- Solution: Combination with laser scanners for dimension measurement

Forced distance between vehicles

Ways to Address Weighing Avoidance

Driving between Lanes or Around Sensors

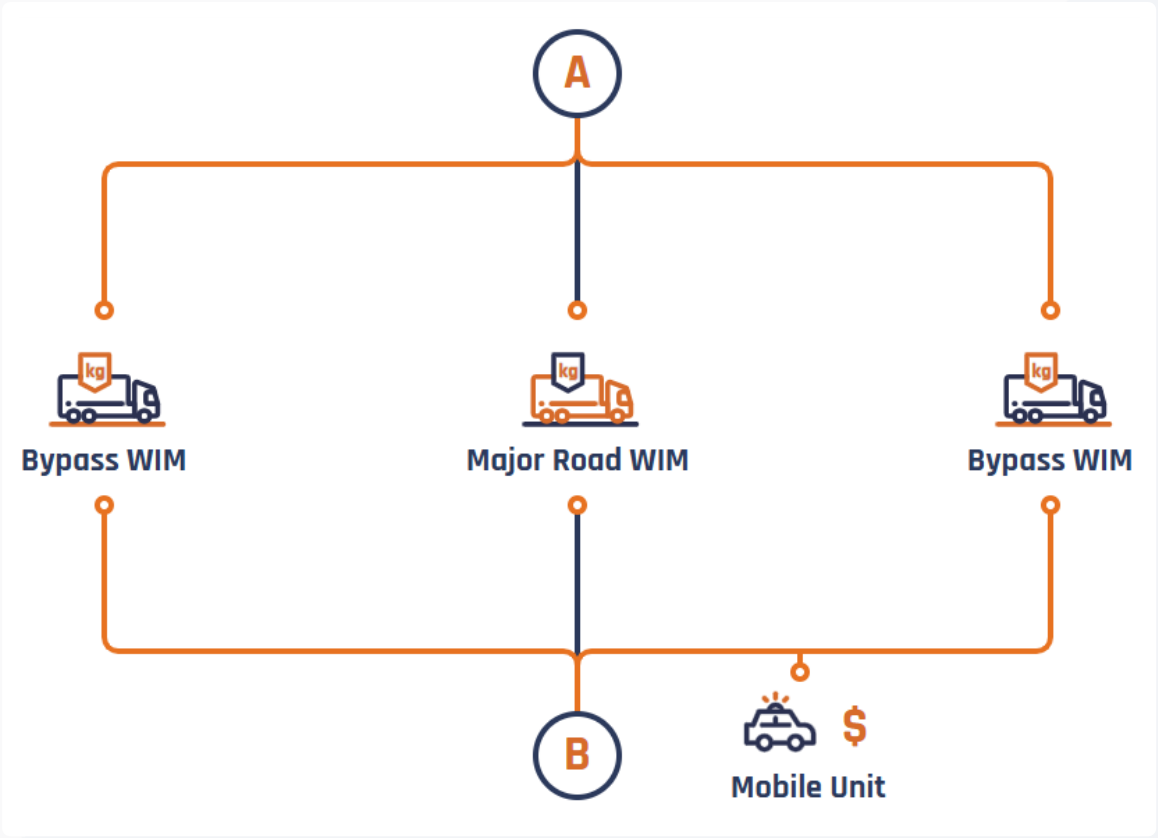
- WIM Enforcement: Measurement in the whole width of the road with accurate position of the vehicle
- Bonus Features:
  - Possible measurement even on road shoulders
  - No need to install barriers or other
  - Dual tire detection and tire pressure measurement using tilted sensors
- Solution: Using weighing sensors and tilted sensors of suitable sizes to cover the full width of the road

Such barriers are unnecessary

Ways to Address Diverting Traffic

Trying to Cover the Whole Road Network

- Installation of WIM and traffic monitoring technologies also on bypass routes:
  - Lower-accuracy (and cost) systems which are not for direct enforcement but can still be an effective tool for monitoring overweight vehicles
  - Systematic evaluation of records in the database to pinpoint offenders to be fined by mobile units
  - Using traffic counters for road surveys and maintenance and to effectively plan installation of WIM stations



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