CESTEL

SiWIM
Bridge Weigh-in-Motion

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About CESTEL

CESTEL

- Established in 1978.
- Located in Slovenia, EU.
- 100% private company.
- Main business areas:
  - Dynamic weighing (SiWIM)
  - Static weighing & vehicle dimensions control
  - Exceptional transport control
  - Environment monitoring
  - …

About SiWIM

SiWIM the Bridge Weigh-in-Motion system:

- bridge used as a weighing platform,
- in-house development and production,
- 20 years on global market,

- portability – permanent or short term measurements,
- modulary built,
- highest accuracy level according to ASTM-1318 can be achieved.


America
131
Europe
2467
Asia
1125
Africa
first pilot project 2022
ONE WEEK
MEASUREMENTS


America
131
Alabama
Georgia
Mississippi
New Jersey
Europe
2467
Africa
first pilot project 2022

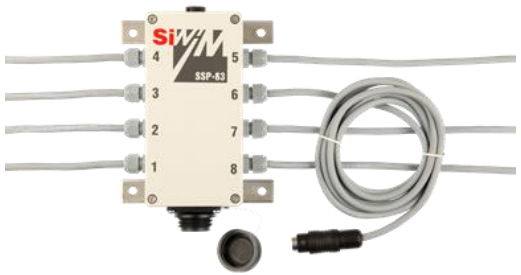
Problem?

Consequences!

Safety?

Every-day traffic

Modular built HW – SiWIM MkIV



SiWIM® – how does it work

SiWIM installation procedure

Measure

Drill

Install

Placement of sensors

Beam bridge

Slab bridge

Steel structure bridge

Work duration

- **Installation**

+

calibration

fine tuning

- **Deinstallation**

Calibration

Precise measurement of:

- Axle loads (**not** GVW)
- Axle distances

Calibration is done under same conditions as for all other WIM technologies.

SiWIM concept ‘nothing on the road‘.

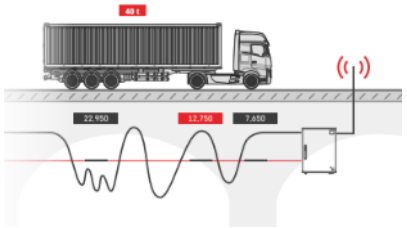
Standard road WIM technology

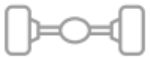
Weighbridge system

Collected data

B-WIM data:

- Axle loads
- GVW
- Vehicle classification
- Axle distances
- Vehicle photo
- Speed
- Load distribution
- Timestamp
- Driving direction



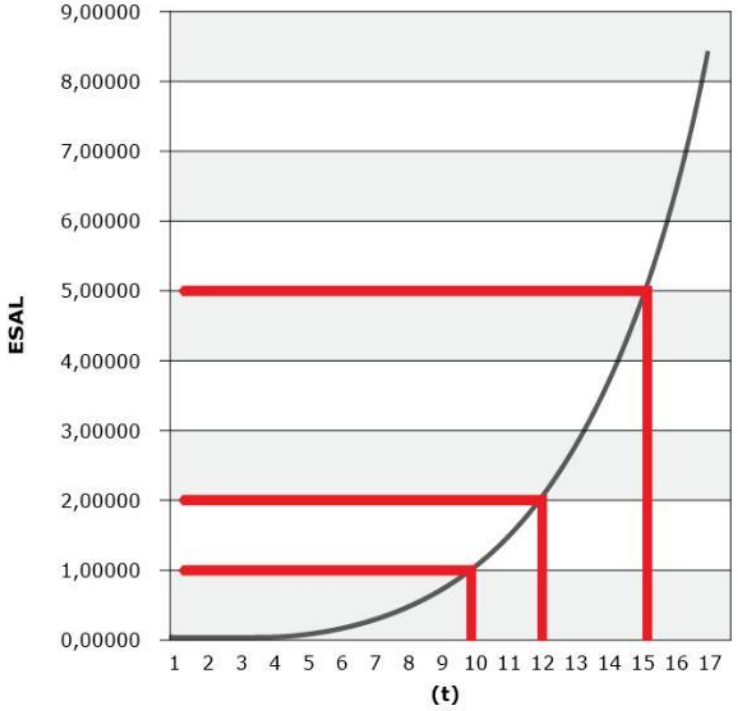


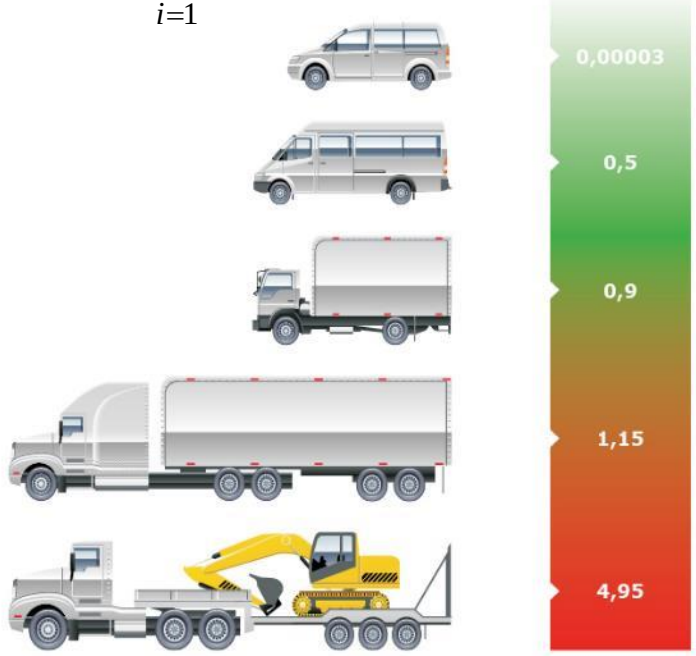
Axle Loads

GVW

ESAL vs TONS

$$ESAL = 10^{-8} \times \sum_{i=1}^{N} f_o \times (f_k \times A_i)^4$$



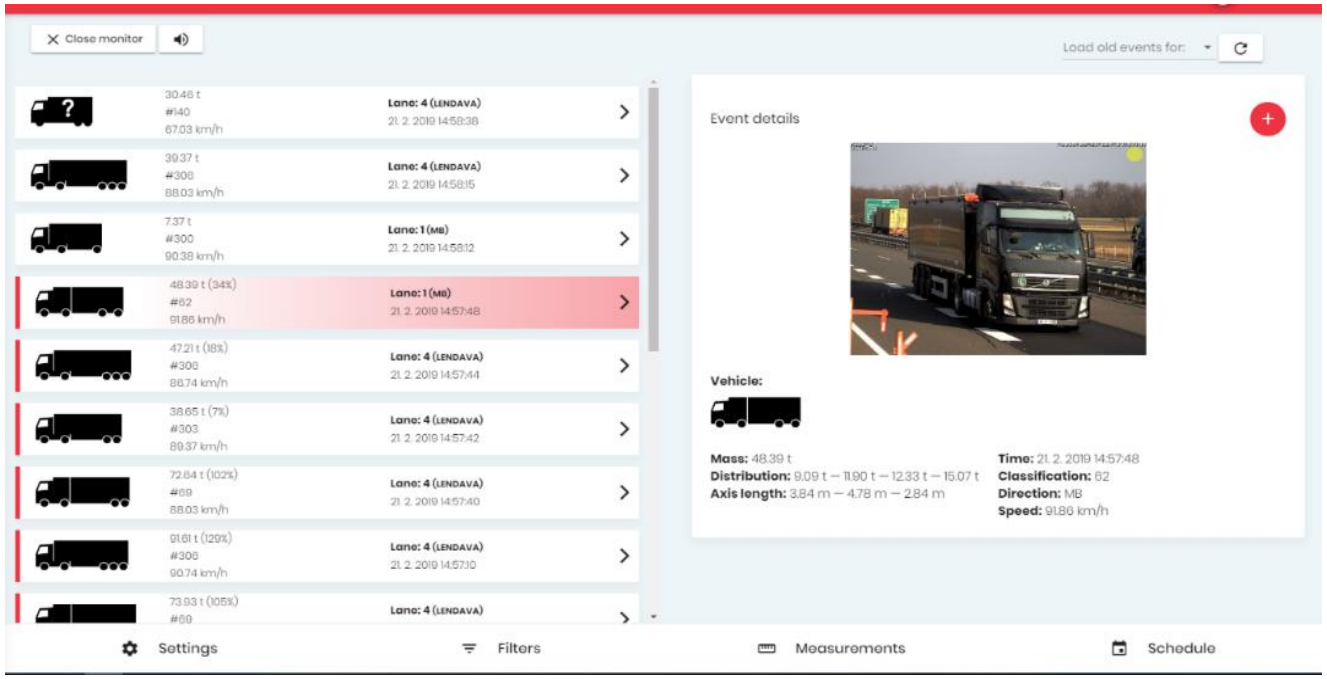


TON	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ESAL	0,0001	0,0016	0,0081	0,0256	0,0625	0,1296	0,2401	0,4096	0,6561	1,0000	1,4641	2,0736	2,8561	3,8416	5,0625	6,5536	8,3521	10,4976	13,0321	16,0000

- 10t axle = 1 ESAL, 12t axle = 2 ESAL
- 20% heavier axle has 100% higher impact on the road

Web based SW for Monitoring and Supervision

- Real-time traffic monitoring.



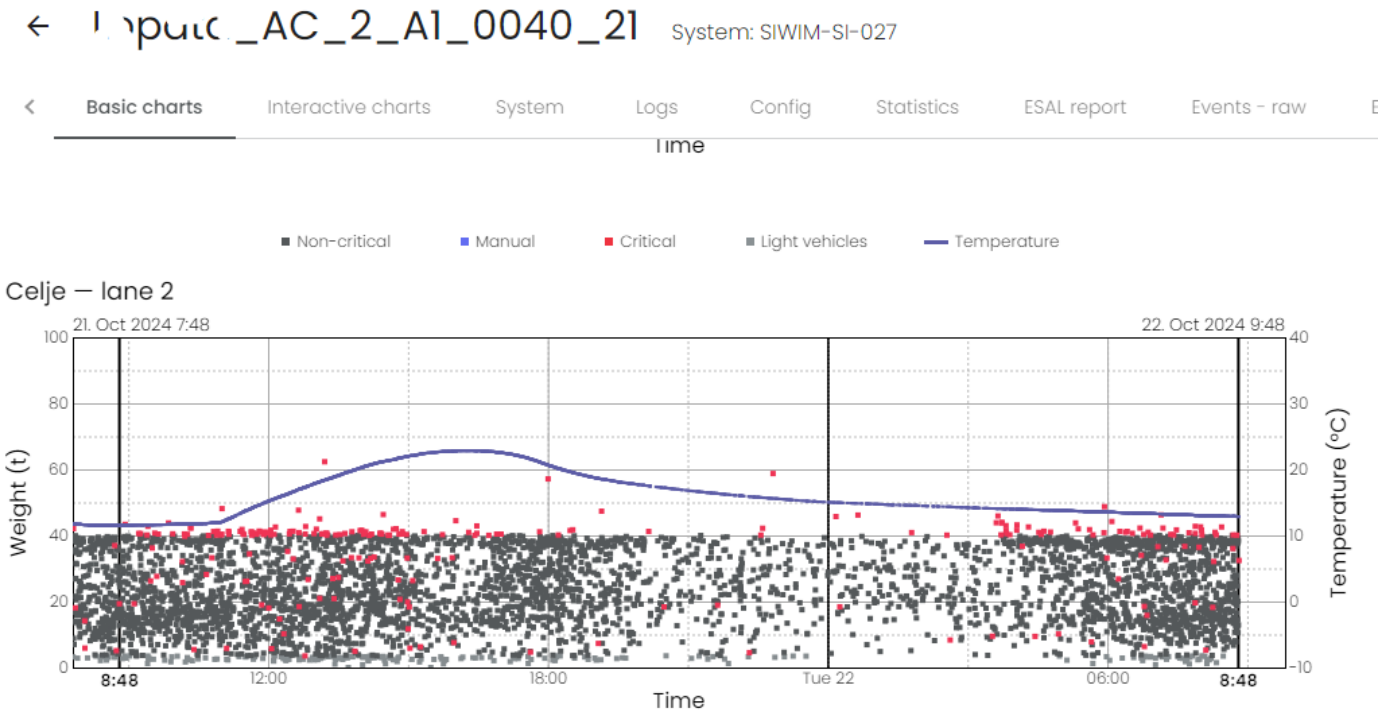
Vehicle:

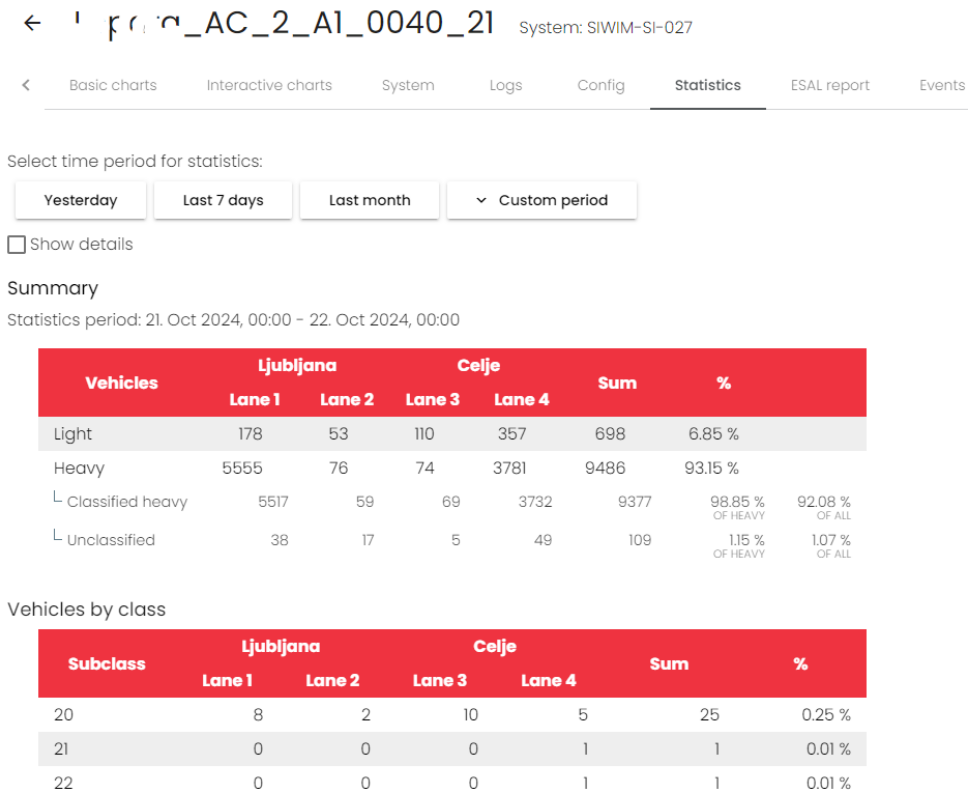
Mass: 35.59 t
Distribution: 7.06 t – 8.29 t – 6.75 t – 6.75 t – 6.75 t
Correction factor: 93 %
Axle distance: 3.65 m – 5.57 m – 1.34 m – 1.34 m
Tyre types: 1 – 2 – 1 – 1 – 1

Time: 22. 10. 2024 10:13:41
Classification: 306
Axle group: 1-1-3
Lane: 1
Direction: Ljubljana
ANPR – front: S K 9
Speed: 89.82 km/h

Web based SW for Monitoring and Supervision

- Control and off-site analysis of the connected systems.





Vehicles	Ljubljana		Celje		Sum	%	
	Lane 1	Lane 2	Lane 3	Lane 4			
Light	178	53	110	357	698	6.85 %	
Heavy	5555	76	74	3781	9486	93.15 %	
└ Classified heavy	5517	59	69	3732	9377	98.85 % OF HEAVY	92.08 % OF ALL
└ Unclassified	38	17	5	49	109	1.15 % OF HEAVY	1.07 % OF ALL

Vehicles by class

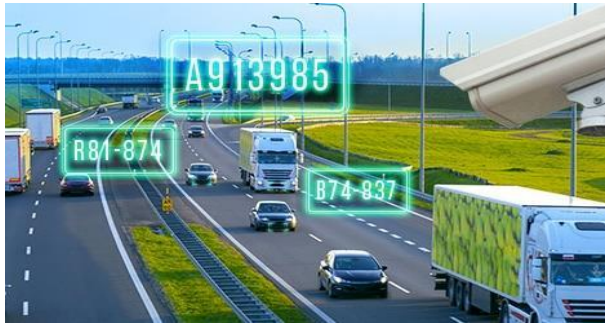
Subclass	Ljubljana		Celje		Sum	%
	Lane 1	Lane 2	Lane 3	Lane 4		
20	8	2	10	5	25	0.25 %
21	0	0	0	1	1	0.01 %
22	0	0	0	1	1	0.01 %

Data from SiWIM can be used for:

- **Traffic studies** (number of vehicles, vehicle classes, overloading,…)
- Road infrastructure analysis:
    - **pavement design and maintenance**,
    - **bridge assessment and monitoring**.
- **Pre-selection for enforcement**.
- Remote monitoring and supervision.
- Calculation of the traffic pattern.

SiWIM +

- ANPR (license plate recognition)
- ADR (dangerous goods recognition)
- VMS (variable message sign)
- Traffic counter
- Traffic control center
- Structural Health Monitoring



Thank you for your attention!

SiWIM you soon!