Weigh-in-Motion and Environmental Data from a German Highway

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Abstract Weigh-in-Motion (WIM) systems capture traffic-induced loads under real driving conditions, providing valuable insights into pavement loading. This dataset was collected within the DFG Collaborative Research Center SFB/TRR 339 "Digital Twin Road" using the project's WIM research system installed on the main lane of the A1/A61 highway near Erftstadt, Germany. It originates from Kistler's KiTraffic Digital system and includes measurements from two sensor rows (four piezoelectric Lineas Digital sensors). Over a six-month observation period in 2025, 3.26 million vehicles with a total of 9.55 million axles were recorded. Each vehicle record provides detailed information on vehicle classification, loads, geometry, and tire-patch dimensions, which are rarely available from real-world WIM systems. In addition, separate environmental factors — such as asphalt and air temperature as well as solar irradiance — were recorded. The dataset supports analyses of load distributions, traffic composition, environmental factor, and speed characteristics, contributing to data-driven modeling of infrastructure loading and digital twins of road systems.

1. Data Overview

The dataset covers a six-month period from April to September 2025 and was recorded with the Weigh-in-Motion (WIM) research system within the DFG Collaborative Research Center SFB/TRR 339 "Digital Twin Road" [1]. The WIM research site is located on the A1/A61 highway near Erftstadt, Germany, and covers traffic on the main lane, where the majority of heavy vehicles travel.

The data is based on four of ten installed Kistler Lineas Digital sensors, two inductive loops, three asphalt temperature sensors, and meteorological instruments. The dataset is stored in the Hierarchical Data Format (HDF5), which includes metadata within the file. The dataset contain two main categories:

1. **Vehicle data**, containing detailed information on individual vehicle passages such as classification, load, and geometric parameters.
2. **Environmental data**, providing parameters such as asphalt and air temperature, humidity, wind and solar irradiance at a 10-minute interval.

During the six-month recording period (183 days), a total of 3,255,259 vehicles were recorded on the main lane of the A1/A61 highway. The share of heavy vehicles amounts to 34%**,** indicating a high fraction of freight transport typical for this highway as it serves as a major transit corridor. A detailed breakdown into 8+1 classes according to TLS 2012 [2] is provided in **Tab. A.3** in the appendix, while **Fig A.1** depicts the distribution of axle counts. The characterization as transit corridor is also reflected in the weekday traffic profile (**Fig. 1**) by the absence of a pronounced rush-hour peak. The mean vehicle speed amounts to 88 km/h, and the corresponding speed distribution is shown in **Fig. A.2**.

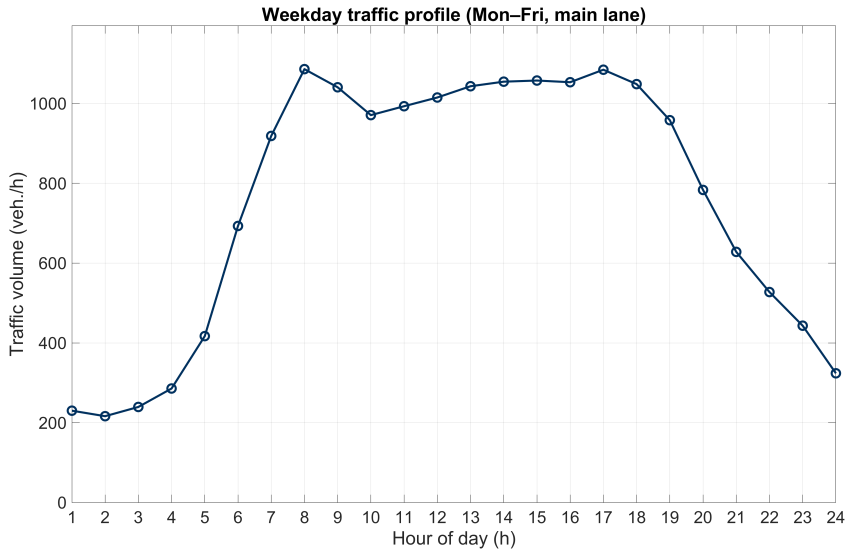

Figure 1. Mean weekday traffic profile (Mon–Fri, hourly mean across weekdays) at the A1/A61 main lane. The weak rush-hour peaks indicate the predominance of continuous freight flows typical for major transit corridors.

The gross vehicle mass (typically named gross vehicle weight or GVW) distribution (**Fig. 2**) exhibits a distinctly bimodal region shape. Passenger cars dominate the first mode below 3 t, whereas the second, broader mode between 15 t and 45 t corresponds to heavy trucks. The pronounced peak about and above 40 t indicates that many vehicles operate close to or even above the legal limit of 40 t for articulated trucks, confirming the high share of freight transport on the A1/A61 corridor

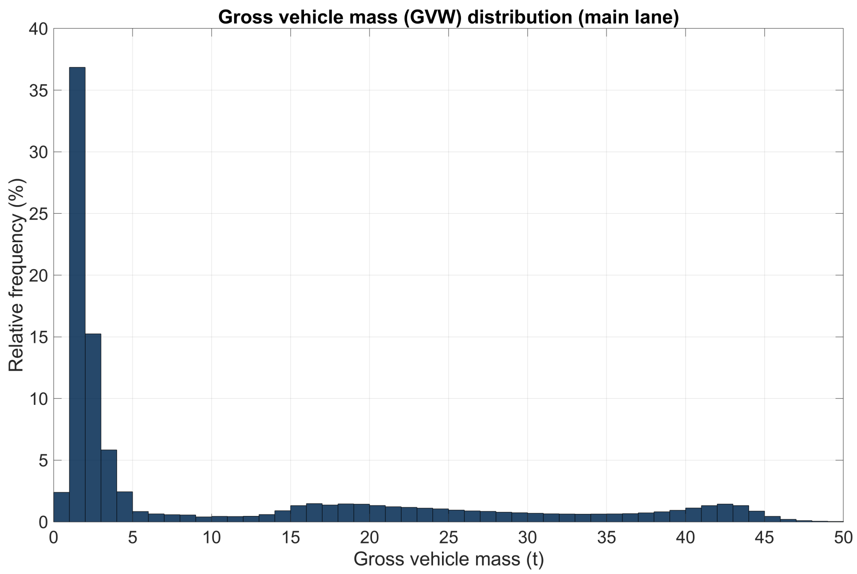

Figure 2. Relative GVW distribution (April–September 2025) on the A1/A61 main lane showing a light-vehicle peak below 3 t and a broad heavy-vehicle range with a maximum over 40 t. The mean is 11.1 t.

2. Research Site and System

The Weigh-in-Motion research system was installed within the SFB/TRR 339 "Digital Twin Road". Its objective is the acquisition of spatially resolved dynamic traffic loads as a fundamental input for developing digital twins of road infrastructure. The research system is designed to capture individual wheel trajectories and the dynamics of loads within a defined spatial domain corresponding to the sensor field, like it is visualized in **Fig. 3**. More information can be found on the project website [3].

Figure 3. Visualization of the research aim: Recording of load trajectories and spatially resolved dynamic traffic loads as an input for the digital twin of the road infrastructure.

2.1 Location

The research site is situated on the joint A1/A61 section near Erftstadt, with the main lane oriented toward Cologne (A1) and Venlo (Netherlands, A61), as illustrated in **Fig. 4** (50.79475° N, 6.80217° E). In this corridor, the A61 functions as the western north–south motorway linking the Netherlands and Belgium to southern Germany while bypassing the congested Cologne ring road, resulting in a high share of Dutch and Belgian heavy-goods traffic. Proximity to the Venlo logistics hubs further increases cross-border freight flows toward the Netherlands. Consequently, the traffic captured at this site is representative of long-distance heavy-vehicle movements on the left-bank Rhine corridor rather than Ruhr area–to–Netherlands flows, which typically use the A3/A40 axis.

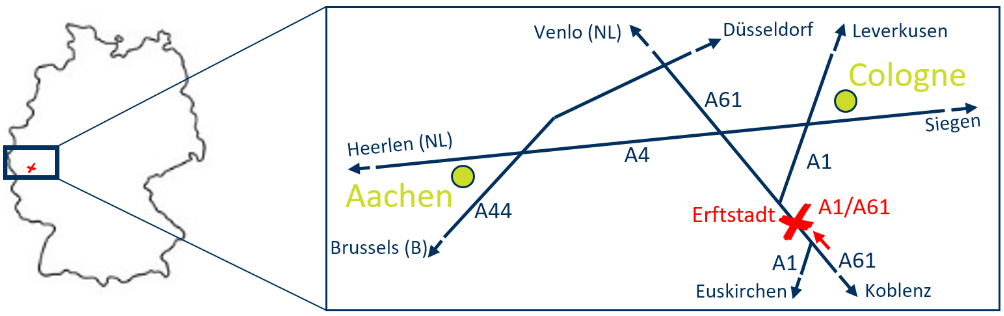

Figure 4. Schematic location of the SFB/TRR 339 Weigh-in-Motion research site near Erftstadt on the joint A1/A61 section within the local Highway network (right) and its position within Germany (left).

The site was selected as a straight highway section with high traffic volume and a substantial share of heavy vehicles (as described above). Further reasons were a minimal longitudinal gradient and an even and damage-free pavement surface. In addition, the location provides access to electrical power via an adjacent variable message sign gantry and allows safe off-highway access through a nearby service road. The WIM research system was installed between 10 and 12 October 2023 and became operational with basic functionality on 16 October 2023. Vehicle classification based on inductive loop data has been active since 3 April 2025.

2.2 Main Components

The installation consists of three principal components, which are indicated by green labels in the aerial image of the A1/A61 WIM research site shown in **Fig. 5**:

1. Road-embedded sensors**,**
2. a weather mast with additional meteorological instrumentation, and
3. a roadside control cabinet housing the data acquisition and communication hardware.

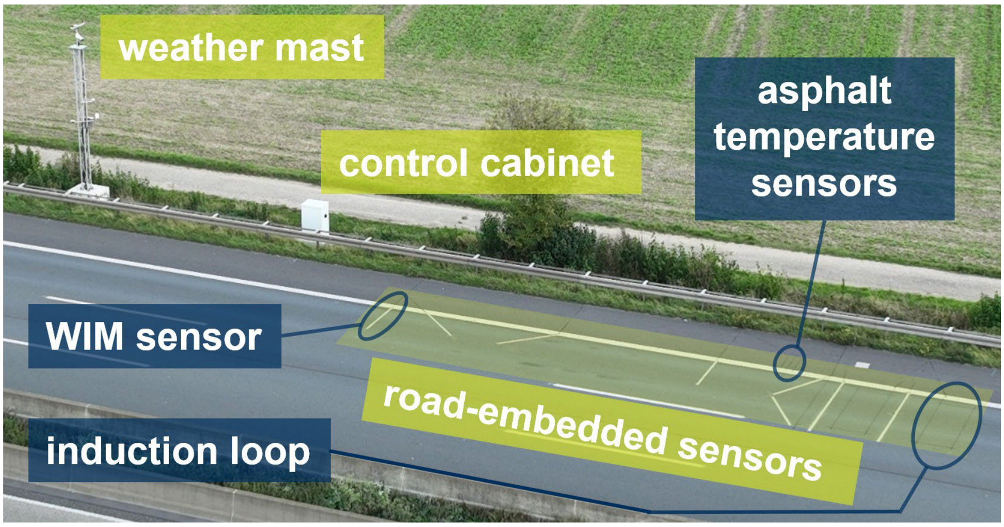

Figure 5. Aerial view of the SFB/TRR 339 Weigh-in-Motion research site on the German highway A1/A61 near Erftstadt. The three main components of the installation are visible: on the left top, the mast equipped with meteorological sensors and a thermal camera; next to it, the control cabinet housing the data acquisition hardware; and below, the road-embedded sensors in the main lane, comprising the in-pavement WIM and inductive loop sensors as well as three asphalt temperature sensors installed at different depths.

2.3 Road-Embedded Sensors

The WIM research system is based on the KiTraffic Digital platform (Type 9845A) manufactured by Kistler Instrumente AG (Winterthur, Switzerland). It comprises ten Lineas Digital piezoelectric quartz sensors (Type 9181A) embedded in the pavement, in this paper also referred to as WIM sensors, as well as two inductive loops.

The first four WIM sensors, arranged in two orthogonal rows, forms with the inductive loops a conventional WIM configuration (cf. **Fig. 6**). Data from this subsystem are processed by Kistler using proprietary software and serve as reference data for developing the overall ten-sensor system. However, the published dataset originates from the conventional four-sensor configuration.

The remaining six sensors are an experimental extension that, together with the conventional system, form the WIM research system. The additional six sensors are installed in a unique combination of standard and diagonal orientations at angles of ±30° and ±45° relative to the standard orientation (cf. **Fig. 6** and **Fig. 7**). This configuration was specifically designed to enable the reconstruction of wheel trajectories and may also enable estimation of load distributions across the tire–pavement contact area. Because of the novel sensor layout, Kistler's proprietary software is not capable of processing the corresponding signals. The raw sensor data are therefore made available to the authors for evaluation within the SFB/TRR 339. Dedicated processing algorithms are currently being developed for this purpose, which is why data from the full ten-sensor system are not yet available for publication. Initial work on associating individual sensor responses with wheels and vehicles has already been presented in [4]. Building on these results, ongoing research focuses on deriving load values from the raw signals, estimating the temporal load dynamics, and ultimately reconstructing the spatial load distribution.

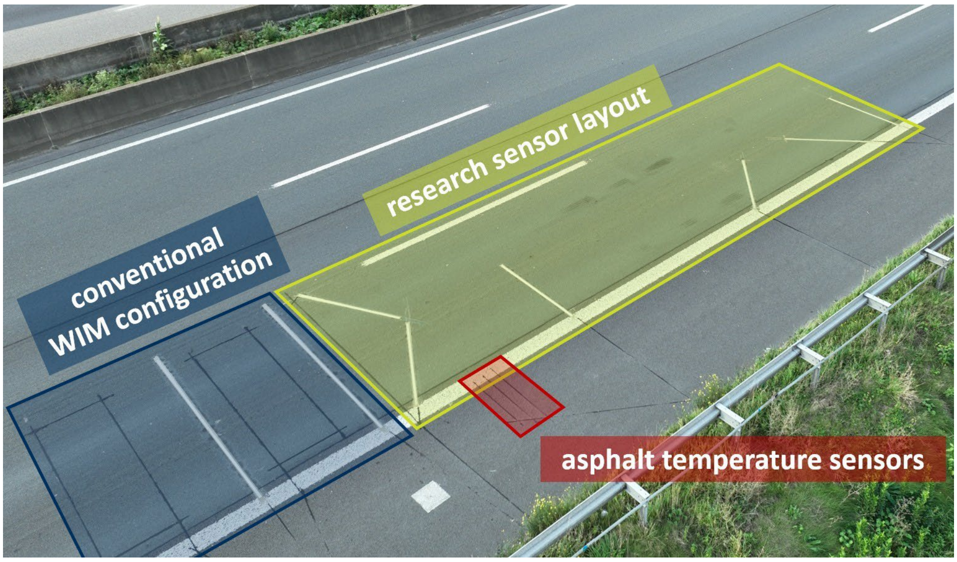

Figure 6. Grouping of the road-embedded sensors at the SFB/TRR 339 WIM research site. The blue section represents the conventional WIM configuration with two sensor rows and two inductive loops, evaluated by Kistler and serving as the source of the published dataset. The green section comprises six additional WIM sensors in a research layout for spatially resolved load measurements. Processing of the signals of the full ten sensor research system is still under development. The three asphalt temperature sensors are marked in red.

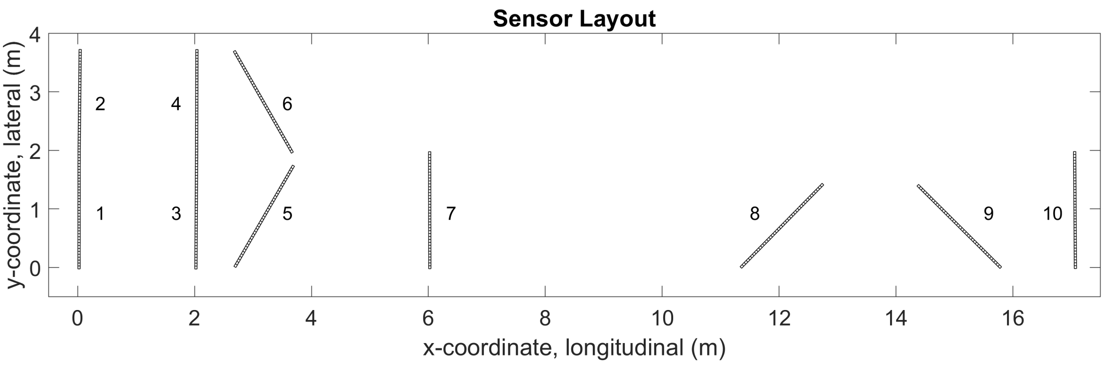

Figure 7. Layout and numbering of the ten road-embedded Lineas sensors forming the SFB/TRR 339 WIM research system. The arrangement includes both conventional and diagonally oriented sensors (±30° and ±45°).

2.4 Environmental Instrumentation

The installation also includes comprehensive environmental monitoring equipment mounted on a 7.1 m weather mast and within the pavement. Three Sensit TG 68 (Pt 100) asphalt temperature sensors are embedded at depths of 4 cm, 8 cm, and 12 cm on the hard shoulder at the lane marking between sensors 5 and 7, with data acquisition via a Moxa ioLogik E1260-T unit. The weather mast hosts instruments manufactured by Adolf Thies GmbH & Co. KG (Göttingen, Germany) measuring wind speed, wind direction, air temperature, relative humidity, global solar irradiance (pyranometer), and binary precipitation occurrence (cf. Fig. 8). The air-temperature, humidity, and precipitation sensors are installed at approximately 3.5 m height (2.6 m above the road surface), the pyranometer at 4.2 m (3.3 m above the road), and the wind sensors for speed and direction at 7.1 m (6.2 m above the road). The pyranometer is positioned to ensure unobstructed exposure throughout the year. Whereas the KiTraffic Digital system captures nearly all passing vehicles, environmental parameters are recorded at 10-minute intervals**.**

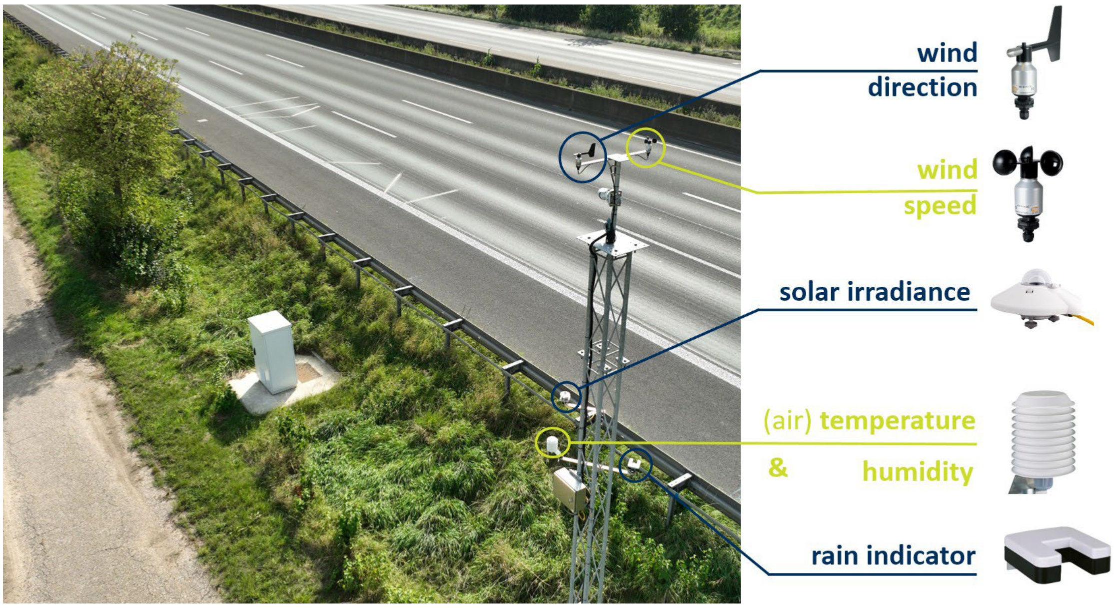

Figure 8. Instrumentation mast of the SFB/TRR 339 WIM research system. The mast is equipped with environmental sensors measuring wind direction, wind speed, solar irradiance, air temperature, relative humidity, and precipitation, and also carries a thermal camera for internal validation purposes. Own figure created using sensor images © Adolf Thies GmbH & Co. KG, used with permission [5].

2.5 Site Layout

The road-embedded sensor area of the WIM research system has a total length of 19 m, with 17 m between the first and last WIM sensors. The roadside control cabinet is located approximately 5 m downstream of the last sensor, and the weather mast about 15 m downstream of the last sensor.

3. Data Acquisition and Processing

The vehicle data used in this dataset originate from Kistler's KiTraffic Digital system, which processes and aggregates the raw signals of the first four Lineas Digital sensors and matches them with the data from the inductive loops. All signal-processing, calibration, and classification routines are proprietary to Kistler Instrumente AG and not publicly disclosed. The system automatically performs wheel and axle detection, load computation, and vehicle-level aggregation within the on-site units in the control cabinet.

Traffic data were accessed through the KiTraffic Digital REST API, which provides structured measurement results in JSONL format. Two types of JSONL files were retrieved: one containing detailed per-vehicle records with timestamps, loads, speeds, and axle configurations, and another containing vehicle-classification results. From these two sources, all relevant fields were extracted and stored in a standardized HDF5 structure for publication.

The classification information included in the API output consists of an internal vehicle-type code assigned by Kistler. Using a reference table provided by Kistler, this internal code was mapped to the German TLS 2012 classification scheme, which defines 5+1 and 8+1 grouping codes based on vehicle silhouette and axle configuration. The mapped TLS class codes were subsequently added to the dataset to ensure standardized compatibility with national traffic data formats.

The meteorological data are synchronized via rsync from the Thies Clima datalogger DLU E, which provides 10-minute mean values of all measured parameters. During installation, the wind sensor was aligned to magnetic north using a compass. Consequently, the raw wind direction values refer to magnetic north. To convert them to geographic north, the magnetic declination of 2.9° E at the installation time was added. The road axis is oriented at 336.5° true with respect to the driving direction. This orientation was taken into account when calculating the wind direction relative to the road axis. Specifically, the measured wind direction (referenced to geographic north) was reduced by 336.5°, and the resulting value was wrapped to the interval [0°, 360°).

The asphalt temperature data were accessed through the REST API of the Moxa ioLogik E1260-T unit.

4. File Structure and Format

The dataset is organized by month, with each month provided as a compressed ZIP archive. Each archive contains one HDF5 file per calendar day, named according to the format *WIM_yyyy-mm-dd.h5*. Each HDF5 file comprises three groups:

1. **Vehicle data: *traffic***
   Contains per-vehicle measurement data recorded by the WIM system, including information on vehicle classification, general attributes, geometric properties, speed, and load parameters such as vehicle gross weight and individual axle loads.

2. **Meteorological data: *meteorology***
   Contains 10-minute mean values of meteorological parameters recorded by the instruments on the weather mast, including air temperature, wind speed, and global solar irradiance.

3. **Asphalt temperature data: *pavement***
   Contains asphalt temperature measurements at depths of 4 cm, 8 cm, and 12 cm, recorded at 10-minute intervals.

The HDF5 format enables efficient storage and structured access to large datasets. The files can be read directly using standard scientific software such as Python (h5py or pandas), MATLAB (h5read), or R (rhdf5). In addition to programmatic access, the data can be manually inspected using the official HDFView application provided by the HDF Group. Extensions for popular development environments such as Visual Studio Code (Microsoft, USA) further allow direct browsing of HDF5 files within the development environment. Each dataset within an HDF5 file is hierarchically organized, facilitating selective loading of vehicle or environmental data as required for analysis. A further advantage of the HDF5 format is that metadata describing variables, units, and attributes can be stored directly within the file, ensuring self-descriptive and portable datasets.

5. Dataset Variables and Metadata

Tab. 1 to **Tab. 3** provide an overview of the information contained in the dataset by listing all relevant measurement variables along with a brief description. A more detailed description, including the exact variable names as used in the dataset and their corresponding units, is provided in **Tab. A.4** in the appendix. Additional metadata are directly available within the HDF5 files. The description of the metadata parameters and values (metadata context) defined within the SFB/TRR 339 is publicly available in [6].

Table 1. Summary of measurement variables included in the dataset in the *traffic* group

Variable	Description
Vehicle Classification and Basic Information	
Vehicle ID	Unique vehicle identifier
Vehicle Type	Description of the vehicle type
Axle Number	Total number of vehicle axles
Axle Configuration	Notation for of the axle configuration
Class 5+1	Vehicle type according to the TLS 2012 classification scheme 5+1 code
Class 8+1	Vehicle type according to the TLS 2012 classification scheme 8+1 code
Timestamp First Axle	Timestamp of the first vehicle axle crossing the first sensor row
Timestamp Last Axle	Timestamp of the last vehicle axle crossing the first sensor row
Vehicle Kinematics	
Vehicle Speed	Vehicle speed between the first two sensor rows
Vehicle Geometry	
Vehicle Length	Total vehicle length
Wheelbase	Distance between the first and the last vehicle axle
Axle Spacing	Distances between consecutive axles
Front Overhang	Distance between the vehicle front and the first axle
Track Width	Track width of each axle
Tire Configuration	Type of the tire configuration (single, dual, wide base)
Vehicle Load	
Gross Vehicle Weight	Total static weight of the vehicle including all axles
Axle Load	Static axle loads
Wheel Loads	Static wheel loads
Tire Contact Patch Length	Length of the tire–road contact patch
Tire Contact Patch Width	Width of the tire–road contact patch

Table 2. Summary of measurement variables included in the dataset in the *meteorology* group

Variable	Description
Meteorological Data	
Timestamp	Timestamp of measurement
Air Temperature	Mean air temperature recorded by the weather station
Air Humidity	Relative humidity recorded by the weather station
Solar Irradiance	Mean global solar radiation at the mast measured with pyranometer
Rain Indicator	Binary indicator of rainfall
Wind Direction	Direction of the wind
Relative Wind Direction	Direction of the wind relative to the driving direction

Table 3. Summary of measurement variables included in the dataset in the *pavement* group

Variable	Description
Pavement Data	
Timestamp	Timestamp of measurement
Asphalt Temperature	Pavement temperature measured 4 cm, 8 cm or 12 cm below surface

6. Data Quality and Limitations

The KiTraffic Digital Weigh-in-Motion (WIM) system used for data acquisition provides high-quality, internally validated measurement results. All Lineas Digital sensors were factory-calibrated by Kistler Instrumente AG prior to installation, ensuring consistent sensor response.

However, the WIM installation has not yet undergone an on-site calibration procedure. Consequently, no statement can currently be made regarding the official accuracy class of the load measurements according to WIM classification standards. The presented load data should therefore be regarded as uncalibrated but internally consistent values suitable for comparative analyses and method development.

As part of the data post-processing, an internal quality control routine was implemented to assess the plausibility of each vehicle record. A validity flag was added to the dataset to indicate whether a measurement is considered reliable. Implausible or corrupted values (e.g., negative loads or speeds) may result from incomplete detections or inconsistencies in the upstream signal processing. These cases are flagged within the dataset and can be excluded during data analysis to ensure data integrity. Based on this procedure, 2.3% of all vehicle records were classified as invalid. Note that additional invalid records may exist, as simple plausibility checks may not detect all cases.

7. Potential Applications

The dataset provides a detailed empirical basis for traffic-load analysis and vehicle characterization on highways. It enables statistical investigations of traffic loading conditions, including load distributions, vehicle-class frequencies, time gaps between load cycles, environmental influences, heavy-vehicle shares, traffic intensity, and speed distributions. These data support data-driven modeling of infrastructure loading and traffic characteristics, as well as the development of digital twins of road systems.

Usage Notes

The dataset is published under the Creative Commons Attribution 4.0 International (CC BY 4.0) license, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original authors and source are credited.

The dataset is intended for research and development purposes related to traffic-load analysis, pavement modeling, and digital-twin applications. Users are encouraged to cite the dataset and the accompanying publication when using the data in scientific or engineering studies. No warranty is provided regarding the completeness, accuracy, or suitability of the data for specific operational purposes.

Conflict of Interests

The authors declare no conflicts of interest.

AI Usage Statement

During the preparation of this manuscript, the authors used OpenAI's ChatGPT (GPT-5) language model to generate initial text drafts and suggestions, to assist in code generation for data processing and visualization, and to support background research. The tool was used with the aim of improving readability, enhancing overall manuscript quality, and working more efficiently. All AIgenerated text, code, and research outputs were critically reviewed and iteratively or manually edited as needed before use or inclusion in the manuscript.

CRediT Author Statement

M.P.M.H.: Conceptualization, Methodology, Software, Validation, Data curation, Writing – original draft, Writing – review & editing, Visualization; **B.J.:** Conceptualization, Methodology, Software, Data curation; **A.F.:** Supervision, Project administration, Funding acquisition; **M.O.:** Supervision, Funding acquisition; **F.H.:** Data curation, Writing – review & editing.

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Citation

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Appendix A

A.1 Classification According to TLS 2012

The classification follows the 5+1 and 8+1 classification schema according to the German *Technische Lieferbedingungen für Streckenstationen* (TLS 2012) [2]. **Tab. A.1** provides the translation of the assigned base classes for 5+1 vehicle classes and **Tab. A.2** for 8+1 vehicle classes.

Table A.1. Classification in 5+1 vehicle classes.

Code	**Class** (translation)	**Assigned base classes** (translation)
1	Passenger car group	Motorcycles, passenger cars, and light commercial vehicles
2	Passenger car with trailer	Passenger cars with trailer
3	Truck	Trucks
4	Truck (combinations)	Trucks with trailer and articulated trucks
5	Bus	Buses
6	Non-classifiable vehicles	Non-classifiable vehicles

Table A.2. Classification in 8+1 vehicle classes.

Code	**Assigned base classes** (translation)
2	Passenger cars with trailer
3	Trucks
5	Buses
6	Non-classifiable vehicles
7	Passenger cars
8	Trucks with trailer
9	Articulated trucks
10	Motorcycles
11	Light commercial vehicles up to 3.5 t

A.2 Dataset Characteristics

Table A.3. Distribution of detected vehicles according to the 8+1 classification defined in TLS 2012 on the main lane of the A1/A61 highway during the six-month recording period.

Class	Description	Share (%)
2	Passenger cars with trailer	3,6
3	Trucks	3,6
5	Buses	0,3
6	Non-classifiable vehicles	11,2
7	Passenger cars	46,5
8	Trucks with trailer	4,3
9	Articulated trucks	22,2
10	Motorcycles	0,1
11	Light commercial vehicles	8,3

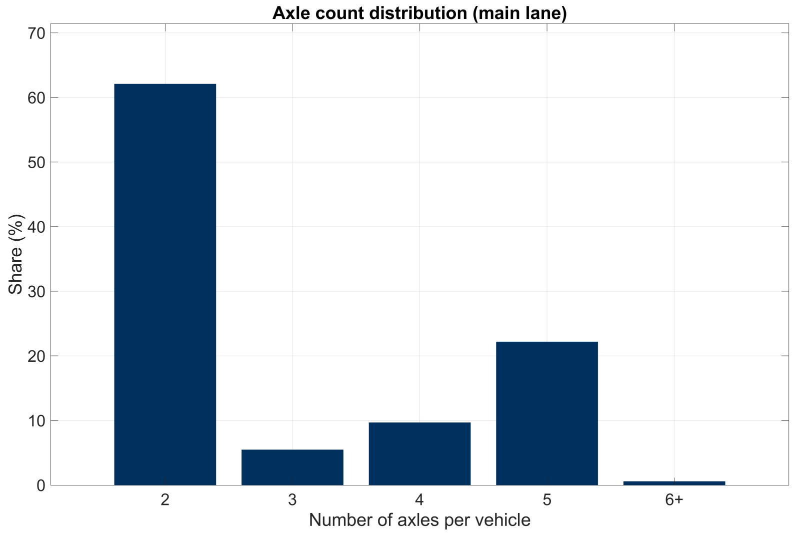

Figure A.1. Axle count distribution on the A1/A61 main lane (April–September 2025) showing a dominant share of two-axle vehicles (passenger cars) and a secondary peak at five axles corresponding to articulated trucks, confirming the mixed but freight-oriented traffic composition. In total, 9,553,743 axles were recorded during the observation period, corresponding to an average of 2.9 axles per vehicle.

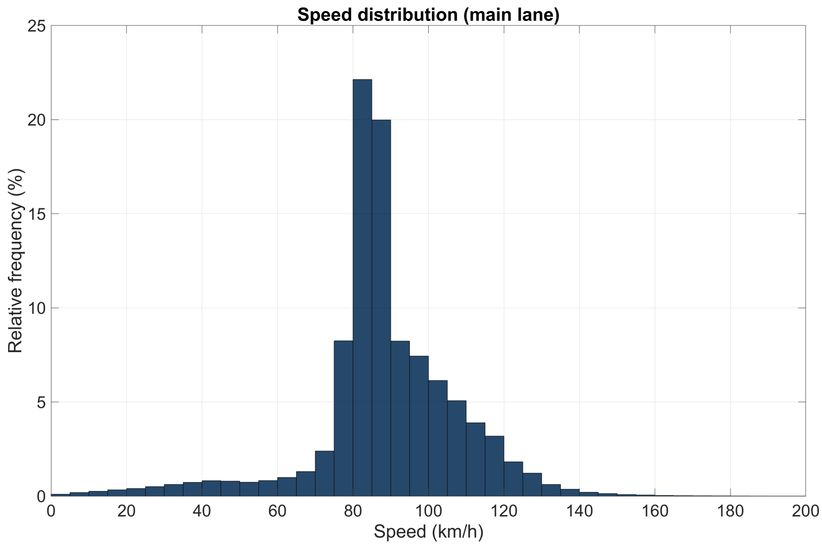

Figure A.2. Relative speed distribution on the A1/A61 main lane (April–September 2025) with a sharp peak around 85 km/h, indicating the dominance of heavy vehicles.

A.3 Detailed Dataset Variable Description

Table A.4. Detailed description of all dataset variables and their corresponding units. Additional metadata are contained directly within the HDF5 file.

Name	Description	Unit
	traffic	
TLS_5+1_code	Vehicle classification according to the German guideline "Technische Lieferbedingungen für Streckenstationen" (TLS 2012) [2] using the 5 + 1 scheme, which distinguishes five defined classes plus an additional category for unclassified vehicles. The value represents the numerical class identifier. For reference, see **Tab. A.1**.	-
TLS_8+1_code	Vehicle classification according to the German guideline "Technische Lieferbedingungen für Streckenstationen" (TLS 2012) [2] using the 8 + 1 scheme, which distinguishes five defined classes plus an additional category for unclassified vehicles. The value represents the numerical class identifier. For reference, see **Tab. A.2**.	-
axle_configuation	Description of the axle configuration, where "S" denotes a single axle, "Ta" a tandem axle, and "Tr" a tridem axle. Individual axles are separated by commas (","), whereas a plus sign ("+") separates towing vehicle and trailer. The sequence follows the order from the vehicle front to the rear. The notation is adapted from the German guideline "Technische Lieferbedingungen für Streckenstationen (TLS 2012)" [2].	-
axle_load	Static axle loads, ordered from the frontmost to the rearmost axle. Given as force. To backcalculate the mass (t), divide by 9.81 m/s^2.	kN
axle_spacing	Distances between consecutive axles, ordered from the frontmost to the rearmost axle pair.	m
day_time	Timestamps of the first (1st Column) and last (2nd column) vehicle axle crossing the first sensor row in format HH:MM:SS.ssssss (ISO 8601)	-
front_overhang	Distance between the vehicle front and the first axle.	m
geographical_reference	Latitude (°N) and longitude (°E) of the WIM research site regarding the Geographic Coordinate System (GCS).	°
number_axles	Total number of axles of the vehicle.	-
time	Timestamps of the first (1st column) and last (2nd column) vehicle axle crossing the first sensor row, measured in seconds from midnight.	s
tire_configuration	Type of tire configuration (0: unidentified, 1: single tire, 2: dual tires, 3: wide-base tire) at each wheel position on the left and right vehicle side, ordered from front to rear. Left vehicle side is in the 1st column and right vehicle side is in the 2nd column.	-
tire_footprint_length	Length of the tire–road contact patch of the right-hand vehicle wheels, ordered from front to rear. Left vehicle side is in the 1st column and right vehicle side is in the 2nd column.	m
tire_footprint_width	Width of the tire–road contact patch of the right-hand vehicle wheels, ordered from front to rear. Left vehicle side is in the 1st column and right vehicle side is in the 2nd column.	m
track_width	Track width of each axle, ordered from the frontmost to the rearmost axle.	m
vehicle_axle	Verbal description of the vehicle axles (first and last) crossing the first sensor row.	-
vehicle_id	Vehicle identifier composed of the recording date (yyyymmdd) and a sequential number representing the vehicle on that day (NNNNN), forming a unique key of the format *yyyymmddNNNNN*.	-
vehicle_length	Total vehicle length measured along the driving direction.	m
vehicle_sides	Verbal description of vehicle sides in driving direction.	-
vehicle_speed	Vehicle speed between the first two sensor rows.	km/h

vehicle_type	Description of the vehicle type in analogy to the German guideline "Technische Lieferbedingungen für Streckenstationen" (TLS 2012) [2], without adopting its or any other formal classification or definition. Possible values are: ["","Unclassified vehicle","Passenger car","Passenger car with trailer","Light commercial vehicle / Van","Light commercial vehicle with trailer","Truck","Truck with trailer","Articulated truck","Special vehicle","Bus","Passenger car group","Truck combination","Motorcycle"]	-
vehicle_validity	dataset validity regarding the crossing vehicle (1:valid record, 0: invalid record)	-
vehicle_weight	Total static weight of the vehicle including all axles. Given as force. To backcalculate the gross vehicle mass (typically referred to as gross vehicle weight or GVW) (t), divide by 9.81 m/s^2.	kN
wheel_load	Static wheel loads of the right-hand vehicle wheels, ordered from front to rear. Left vehicle side is in the 1st column and right vehicle side is in the 2nd column. Given as force. To backcalculate the mass (t), divide by 9.81 m/s^2.	kN
wheelbase	Wheelbase: Distance between the first and the last vehicle axle.	m
meteorology		
air_humidty	Relative air humidity measured at the weather mast as a 10-minute mean over the preceding 10 minutes.	% RH
air_temperature	Air temperature measured at the weather mast as a 10-minute mean over the preceding 10 minutes.	°C
day_time	Timestamps of the measurement given in the format HH:MM:SS	-
geographical_reference	Latitude (°N) and longitude (°E) of the weather mast at the WIM research site regarding the Geographic Coordinate System (GCS)	°
precipitation	indicator of rainfall (precipitation) (TRUE: if rain is observed, FALSE: otherwise or if no data are available)	-
relative_wind_direction	Represents the wind direction relative to the driving direction (roadway axis) measured at the weather mast as a 10-minute mean over the preceding 10 minutes. 0° indicates headwind, 180° tailwind	°
solar_irradiance	Global solar irradiance measured at the weather mast as a 10-minute mean over the preceding 10 minutes.	W/m^2
time	Timestamps of the measurement, measured in seconds from midnight.	s
wind_direction	Wind direction measured at the weather mast as a 10-minute mean over the preceding 10 minutes, indicating the direction from which the wind originates and referenced to true (geographic) north.	° true
wind_speed	Wind speed measured at the weather mast as a 10-minute mean over the preceding 10 minutes.	m/s
pavement		
asphalt_depth	Depths of asphalt temperature sensors in the pavement below the road surface.	cm
asphalt_temperature	Asphalt temperature measured at a depth of 4 cm, 8 cm and 12 cm (column from left to right) below the road surface.	°C
day_time	Timestamps of the measurement given in the format HH:MM:SS	-
geographical_reference	Latitude (°N) and longitude (°E) of the asphalt temperature system at the WIM research site regarding the Geographic Coordinate System (GCS)	°
time	Timestamps of the measurement, measured in seconds from midnight.	s