Roadside Traffic Data Collection

Requirement specification

3.2 RTDCE for bicycles

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Introduction

This document covers the requirements related to Roadside Traffic Data Collection Equipment (RTDCE) for bicycles.

Separate documents describe the interface used for communication between RTDCE and the back office system, Datainn, (OPC UA).

This document serves the following purposes:

- It is the basis for the response to the Tender documents.
- Development of a test plan and at a later stage, detailed test procedures, for qualifying the equipment on the requirements in this document.

The audience for this document is:

- The bidders for the RTDC equipment
- The Contractor's personnel who is involved in realising the system being: HW/SW engineers involved in development, test engineers and project management.
- The customer's personnel who are involved in the commissioning of the delivered RTDC equipment.

Definitions

The glossary in Table 1 is an alphabetical list with the explanation of terms and phrases used in the specifications.

Table 1. Alphabetical list

API	Application programming interface
Continuous traffic data collection	Continuous in this context means permanent installations collecting traffic data 24/7
Data owner	Norwegian Public Roads Administration will be the owner of all data collected in connection with the traffic data system
DHCP	Dynamic Host Configuration Protocol
Ethernet	Computer networking technologies for local area networks
GNSS	A Global Navigation Satellite System (GNSS) is a space-based satellite navigation system that provides location and time information
GPS	The Global Positioning System (GPS) is a GNSS
Mobile traffic data collection	Short term traffic data collection with non-permanent installation without fixed power, with or without continuous data transfer.
NPRA	Norwegian Public Roads Administration
NTP	Network Time Protocol is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks.
OPC UA	Open Productivity & Connectivity, Unified Architecture. An open and contractor independent standard for transfer of process data.
Operational uptime	The percentage of time the equipment is in a condition to perform its intended function
Periodic traffic data collection	A planned and determined period of traffic data collection. Installations can be permanent, but may not have fixed power or continuous data transfer.
RTDCE	Roadside Traffic Data Collection Equipment All equipment installed at the roadside with the main objective of collecting information on vehicles and pedestrians.

	NOTE 1: The sensors not integrated in the RTDCE itself are not part of the RTDCE, e.g. inductive loops and piezoelectric cables installed in the road pavement. *NOTE 2: Any traffic sign or road user information equipment, e.g. bicycle displays and vehicle speed information signs, is not part of the RTDCE.*
SAT-test	Site Acceptance Test
Technical service life	A product's technical service life is its expected lifetime, or the acceptable period of use in service. It is the time that any manufactured item can be expected to be 'serviceable' or supported by its manufacturer.
UTC	Coordinated Universal Time, the primary time standard by which the world regulates clocks and time
VbV	Vehicle by vehicle, i.e. every vehicle shall be detected and handled individually
Vehicle	Motor vehicle or bicycle

References and standards

[1] *4.1 RTDCE interface - OPC UA.*

[2] *5.1 RTDCE - Test Strategy.*

1. General description

Automated and real-time collection, mining and application of big data from the roads network is key for the NPRA in order to monitor, plan and manage roads and traffic. The network of traffic sensors spread throughout the country collects traffic data in real time – volume, vehicle types, traffic speeds and density on the roads – on a 24/7 basis. The sensor network generates vast volumes of data (ie "big data"), and the ambition of the NPRA is to publish raw and enriched data openly for third party entities, the public in general and real time data management systems in order to rationalise road maintenance, anticipate and manage traffic, uncover safety hazards and improve road safety.

In short, the sensors collect passing motor vehicle and bicycle information, convert the data into traffic event data and submit (via roadside network equipment) the events to the Datainn platform for further processing and storage. All information exchange between the roadside equipment and the Datainn platform uses the OPC UA standard [1]. A distributed architecture in Datainn ensures very high performance and scalability, while enabling close to real-time detection of certain types of abnormal traffic patterns or traffic hazards.

1.1 Description of objective/requirements

Norwegian Public Roads Administration (NPRA) is responsible for collecting traffic data on the national and county road network in Norway. A distinction is made here between bicycle traffic and motorised vehicles. Recording of traffic takes place at both fixed data collection sites with monitoring throughout the year, so-called continuous data collection, and periodic or mobile traffic data collection in fixed or non-fixed sites.

The NPRA invites tenders for delivery of equipment for continuous, periodic and mobile data collection of bicycle traffic according to specified requirements.

1.2 Goals for the delivery

The delivery shall contribute to realising general objectives and strategies with respect to collection of traffic data.

The primary goals for the whole system is that collection of traffic data should take place efficiently, and achieving high quality data both for real-time observation and traffic statistics. The data owner (NPRA) must have full control of the data, and not be dependent on obtaining data via a third party.

The NPRA wishes to enter into a framework agreement with Contractors who can offer reliable, appropriate and innovative roadside traffic data collection equipment for bicycles.

Separation of concerns. The Contractors are responsible for their own RTDCE, while the NPRA is responsible for everything else in the traffic data collection ecosystem. This ensures

a maximum degree of transparency, supporting the aim of acquiring traffic data where quality parameters (such as % of vehicles registered, quality of speed measurements) are as transparent as possible for the NPRA.

The NPRA aims for a data collection system where

- The collected traffic data satisfy the specified data quality requirements
- Observation data is acquired in a uniform manner from systems using OPC UA interface
- The system requires a minimum of administration and maintenance, particularly onsite, and is reliable, robust and flexible

1.3 System for collecting traffic data

1.3.1 Principles and overview

The overall objective is to have a differentiated traffic data collection system where one uses the technology that is most appropriate in relation to the data needed, local conditions and available infrastructure.

The main principle for roadside traffic data collection is that the data must be processed on a VbV basis.

All equipment offered in this tender will be placed into the NPRA Data Acquisition Network, a separate, private and isolated VPN. NPRA routers are deployed roadside, extending this network from the roadside cabinets to our central data centers. Later, the possibility of data transfer through NPRA's Data Acquisition Network may be facilitated by using SIM cards installed on the RTDCEs.

Equipment in the NPRA Data Acquisition Network will not access the public internet. Inbound VPN access can be arranged, allowing troubleshooting or similar tasks.

The RTDCE shall provide a light weight operational historian[1], or a buffer, from which data can be transmitted, and retransmitted if needed, for example if there was a communications network outage during the initial transfer attempt.

The solution will consist of RTDCE providing a local, built-in OPC UA server. See [1] for a more detailed description of the use of OPC UA for collecting traffic data.

The central system Datainn will act as an OPC UA client.

[1] A time-based database for telemetry and process information.

Accumulation of data will take place in the central system. This system is not a part of the tender. A test kit simulating the interface to Datainn will be made available for the Contractors for testing purposes.

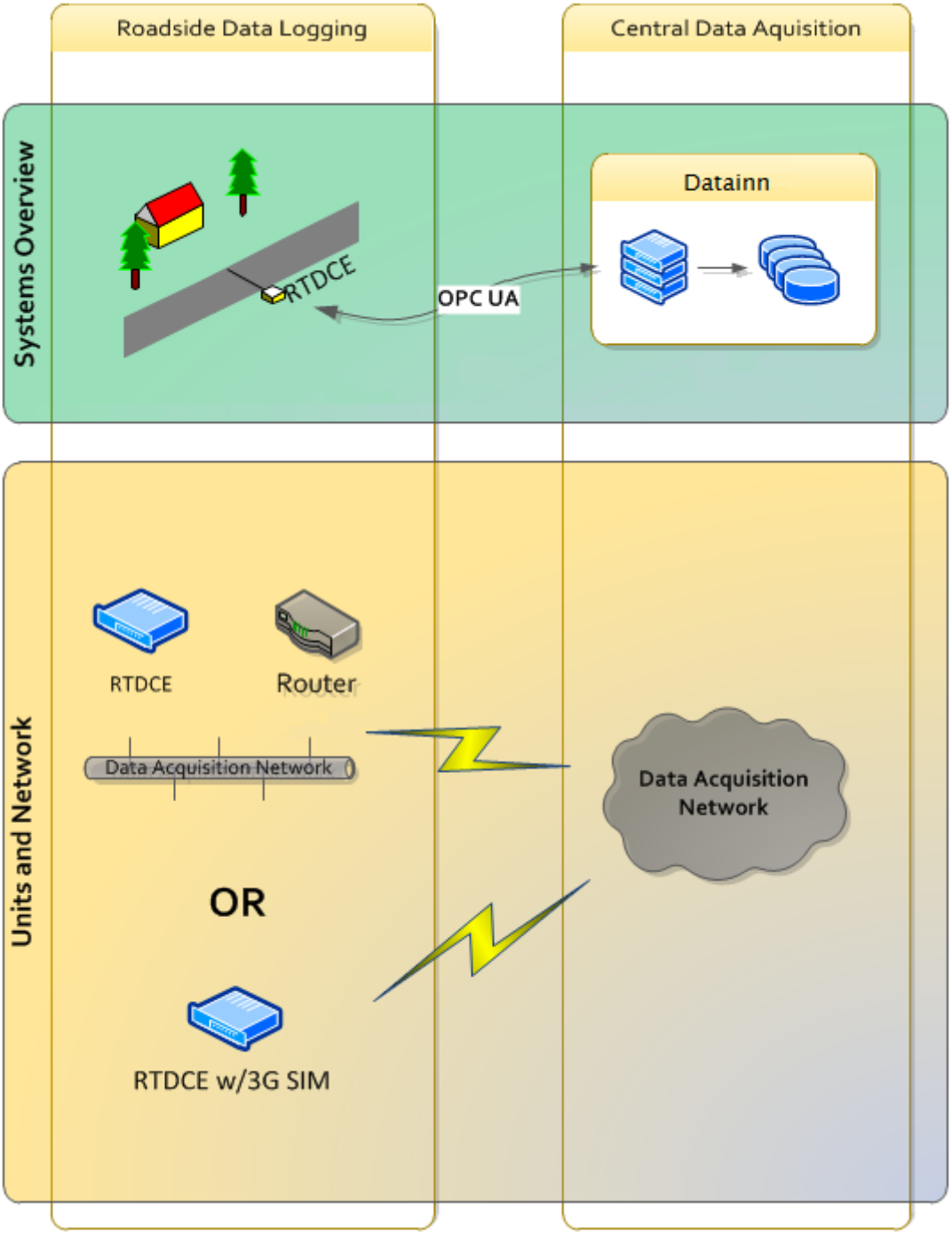

Figure 1. System overview for traffic data collection.

1.3.2 Vehicle parameters

The equipment for registration of bicycles shall collect data with parameters as specified in the address space for OPC UA, described in [1].

1.3.3 Measuring accuracy for bicycle traffic

Table 1 shows the requirements for measurement functionality and accuracy for different parameters. Note that the specified requirements for measuring accuracy are to be regarded as indicative requirements. The requirements can be set higher in mini tender competitions. Further clarification will be made in the specification that follows the individual mini tenders.

Table 1 Measuring accuracy for bicycle traffic

Parameter	Definition/ Application	Requirements for measuring accuracy	
		Unit	Accuracy
Bicycle detection	Registration of bicycle units		Minimum 90%
Timestamp	Timestamp for bicycle registration	UTC milliseconds	
Lane	Lane number for bicycle registration	Integer	Minimum 90 %
Direction	Direction of bicycle	Vehicle direction parameter	Minimum 90 %
Optional bicycle parameters:			
Quality meta-data	To be specified by Contractor		
Bicycle speed	Bicycle direction is indicated by sign of number	km/h	
Other bicycle parameters	To be specified by Contractor	metric (if applicable)	To be specified by Contractor
Pedestrian registration			
Pedestrian detection	Registration of pedestrians		To be specified by Contractor
Timestamp	Timestamp for pedestrian registration	UTC milliseconds	
Lane	Lane number for pedestrian registration	Integer	
Direction	Direction of pedestrian		
Optional: Other pedestrian parameters	Quality meta-data etc. to be specified by Contractor		To be specified by Contractor

2. Description of the delivery

2.1 In general

The purpose of this tender is to enter into framework agreements for the acquisition of equipment for continuous and periodic traffic data collection regarding bicycle traffic. Equipment regarding motor vehicles are covered in other framework agreements. Although some technologies / equipment may be used for all purposes, it has been found convenient to divide the assignment in the following two parts:

A Equipment for traffic data collection regarding bicycle traffic, with permanent installation

A.1. Continuous traffic data collection – fixed power grid

A.2. Periodic traffic data collection – may require use of battery or alternative power sources.

B Equipment for traffic data collection regarding bicycle traffic, with non-permanent installation

B.1. Mobile equipment for traffic data collection

2.2 Scope

2.2.1 Objectives and principles for procurement

This specification is a functional specification for equipment for registration of bicycles. The Contractors must meet the functional requirements within the requested application areas.

The actual equipment procurement will be arranged through mini tender competitions.

2.2.2 What the delivery will include

The specification of requirements describes the area within the red square in figure 2. Local presentation of traffic data collected, for example in the form of a bicycle display, is an option.

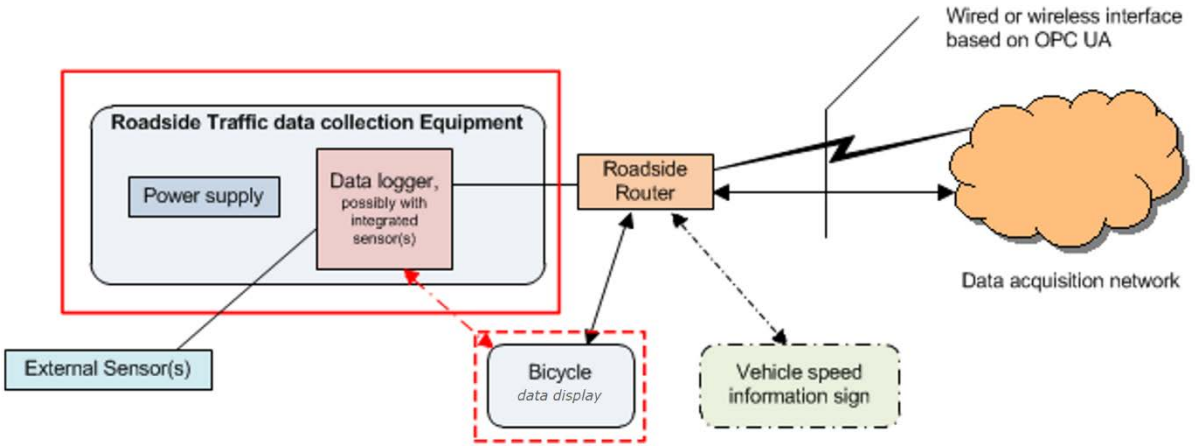

Figure 2. Main elements in the specification

The delivery includes the supply of RTDCE, which can be either complete registration units with sensor features integrated or can be connected to external sensors, for example, inductive loops and piezoelectric cables. The sensors are not a part of the tender, unless it is/they are integrated in the RTDCE. The procurement includes interface based on OPC UA, see [1].

Later mini tender competitions can request an extended functionality of the RTDCE to also handle registration of pedestrians. The Contractor should describe any additional hardware or software needed, including external sensors.

2.2.3 Structure

This specification consists of requirements for equipment for continuous, periodic and mobile registration of bicycle traffic.

The specifications are divided into technical and performance requirements, requirements for the communication interface are given in [1].

The test strategy is described in [2].

3. Technical requirements

All of the minimum requirements can be altered in the mini tender competitions, however the NPRA shall give fair warning of which requirements that are to be tightened. See SSA-R appendices.

3.1 General technical requirements

ID	Requirements	Gradation	Part	Test

3.1.1	The guarantee period for the RTDCE shall be in accordance to clause 2.1.6 in the SSA-K-condensed.	Absolute	A, B	
3.1.2	The technical service life shall not be less than 10 years.	Absolute	A, B	KPI
3.1.3	The Contractor shall describe procedure and expected delivery time for replacement of defect equipment.	Absolute	A, B	
3.1.4	Operational uptime of the RTDCE shall be minimum 99 %, measured as an average of all units per mini tender 24/7 per month. See SSA-V appendices for further details.	Minimum	A, B	KPI
3.1.5	Packaging and RTDCE shall be labelled with: • which type(s) of traffic it is used to register, i.e motor vehicles, bicycles or pedestrians • QR code and human readable text displaying RTDCE serial number • QR code and human readable text displaying MAC address The QR code shall be encoded at Level H (High) error correction. The QR code physical dimensions shall be no less than 3cm x 3cm. 4cm x 4cm is recommended. The tender shall give an example or otherwise describe what the labelling will look like, and where it will be located on packaging and RTDCE. These are our suggestions, made with http://www.racoindustries.com/barcodegenerator/2d/qr-code.aspx (examples are not to scale): Serial number S1337 MAC address 001122334455	Absolute	A, B	DVT

3.2 Installation requirements

ID	Requirements	Gradation	Part	Test
3.2.1	Physical dimensions and placing of the RTDCE and the necessary equipment for its intended use may be limited in the mini tender.	Absolute	A, B	DVT
3.2.2	The installation procedure and guidelines for the RTDCE shall provide an easy and user friendly installation with ordinary mounting tools.	Absolute	A, B	DVT SAT-T

3.3 Environmental requirements

ID	Requirements	Gradation	Part	Test
3.3.1	RTDCE exposed to open air shall tolerate normal road maintenance such as sweeping, snow-clearing, scattering of gravel and salting.	Absolute	A	DVT FAT KPI
3.3.2	Electronic units and equipment that are installed in a cabinet shall function properly within the temperature range -40°C to +80°C.	Absolute	A, B	DVT KPI
3.3.3	Electronic units, sensors and equipment that are exposed to the open air must function properly within the temperature range -40°C to +40°C.	Absolute	A, B	DVT KPI
3.3.4	Equipment in cabinets must as a minimum meet the requirements for IP31.	Minimum	A, B	DVT KPI
3.3.5	Equipment that is exposed to the roadside environment outside a cabinet must as a minimum meet the requirements for IP64.	Minimum	A, B	DVT KPI
3.3.6	Sensors and equipment that is exposed to open air shall work within the moisture range of 5% to 100%.	Absolute	A, B	DVT KPI

3.4 Power supply and electricity requirements

ID	Requirements	Gradation	Part	Test
3.4.1	All electronic equipment shall be checked and approved in accordance with applicable regulations.	Absolute	A, B	DVT
3.4.2	The contractor must specify the battery (12 V) needed to be used as a backup for minimum four days of data collection and local traffic data storage. The backup battery itself is not a part of the tender.	Absolute	A	DVT SAT-T KPI
3.4.3	The contractor must specify the battery (12 V) needed to operate a periodic data collection for a minimum of 14 days with the following data transfer scenarios: • Continuous data transfer • Data transfer every hour • Data transfer once a day • Without data transfer during the registration period	Absolute	A	DVT SAT-T KPI
3.4.4	Mobile equipment (part B) must include battery sufficient for at least one month of operation with the following data transfer scenarios: • Continuous data transfer • Data transfer every hour • Data transfer once a day • Without data transfer during the registration period It shall be easy to replace the battery.	Minimum	B	DVT SAT-T KPI
3.4.5	The units shall be equipped with cables to connect the unit to the Norwegian fixed electrical grid and battery backup. The type of power supply will be specified in mini tenders.	Absolute	A	DVT
3.4.6	The RTDCE must have diodes or display showing at least - If the unit is connected to power	Absolute	A, B	DVT SAT-T

	- If the unit is detecting vehicles - if the unit is connected to a network			SAT

3.5 Time and positioning

ID	Requirements	Gradation	Part	Test
3.5.1	Every vehicle registration must be time-stamped using the UTC millisecond format.	Absolute	A, B	DVT SAT-T SAT
3.5.2	The station shall be equipped with a standard GNSS receiver that supports EGNOS. GNSS is used for both timestamp and positioning. GNSS shall be used as the primary source for timestamp.	Absolute	A, B	DVT SAT-T
3.5.3	The device shall be able to synchronize the clock with external sources using NTP. NTP shall be used as the secondary source for timestamp.	Absolute	A	DVT SAT-T
3.5.4	In the case of no available synchronisation via GNSS or NTP, the internal clock must not have an expected drift of more than one minute per month. The Contractor shall specify the expected drift per month of the internal clock.	Absolute	A, B	DVT KPI
3.5.5	The unit shall have user configurable time and date settings.	Absolute	A, B	DVT SAT-T
3.5.6	The RTDCE shall have a standard SMA connection to the GNSS antenna.	Absolute	A, B	DVT
3.5.7	Positions from GNSS shall use decimal degrees with at least five decimals for latitude and longitude indicating the position of the RTDCE.	Absolute	A, B	DVT SAT-T SAT

3.6 Data storage and control of data quality

ID	Requirements	Gradation	Part	Test
3.6.1	After a total loss of power the RTDCE unit shall start up automatically without requiring reconfiguration, and resume normal operation without manual intervention.	Absolute	A, B	DVT SAT-T SAT
3.6.2	Traffic events must be stored internally in such a way that in the event of a power loss, the unit shall not lose more than one – 1 – minute of traffic data due to in memory storage, other internal configuration choices by the Contractor or other factors within the Contractors control.	Absolute	A, B	DVT SAT-T SAT KPI
3.6.3	The RTDCE shall be equipped with sufficient memory to store vbv data equivalent to 120 000 events per day for at least three months before any new data overwrites the oldest data. Thus the buffer shall not be overwritten until its capacity is at / near max, to ensure a minimal chance of data loss.	Absolute	A, B	DVT KPI
3.6.4	Should the data storage become full, the oldest data must be overwritten first.	Absolute	A, B	DVT KPI

	The unit shall never fail because the data store is full. The Contractor shall describe how a full data storage will be handled.			
3.6.5	Each stored data object shall have a unique numeric sequential identity as described in [1].	Absolute	A, B	DVT SAT-T SAT
3.6.6	In case of communication failure between the station and the central data acquisition system (no matter the cause – network, OPC UA connection etc.), the unit shall continue to collect and store data locally.	Absolute	A, B	DVT SAT-T SAT
3.6.7	If the unit calculates quality meta-data connected to its measured attributes on the bicycle registrations, then this data must be transmitted along with the data in the record or measurement.	Wanted functionality	A, B	DVT SAT-T

3.7 Interface and communication

ID	Requirements	Gradation	Part	Test
3.7.1	Communication between Datainn and RTDCE shall comply with description in [1]. The OPC UA interface can be adjusted or extended during the contract period.	Absolute	A, B	DVT SAT-T
3.7.2	Contractor shall specify a development plan for OPC UA compliance.	Absolute	A, B	DVT
3.7.3	Firmware update shall be opaque /atomic and initiated remotely for a fleet of RTDCEs over OPC UA, using methods described in [1].	Absolute	A, B	DVT SAT-T KPI
3.7.4	RTDCE shall have an Ethernet port for connection with the central system.	Absolute	A, B	DVT SAT-T
3.7.5	The interface for RTDCE configurations shall be OPC UA.	Absolute	A, B	DVT SAT-T
3.7.6	The interface/cable(s) between the RTDCE and any external sensors must be included in the delivery.	Absolute	A, B	DVT SAT-T
3.7.7	It must be possible to do onsite validation of lane and direction of passing vehicles, via local connection to the RTDCE.	Absolute	A, B	DVT SAT-T SAT

3.8 Documentation

ID	Requirements	Gradation	Part	Test
3.8.1	All documentation shall be given in English or a Scandinavian language.	Absolute	A, B	DVT SAT-T
3.8.2	The user manual. Contractor shall provide guidance in installation, use and maintenance of the equipment.	Absolute	A, B	SAT-T
3.8.3	The contractor shall provide technical support for the delivered RTDCE. Information on support line (phone, email and hours of support) must be supplied in the tender.	Absolute	A, B	DVT SAT-T

3.8.4	The system manual shall include a detailed technical description of all equipment intended for use by system administrators in the NPRA.	Absolute	A, B	DVT SAT-T
3.8.5	The contractors must provide a change log with each firmware update as described in [1].	Absolute	A, B	KPI
3.8.6	If the Contractor's wishes to extend the OPC UA namespace with additional node, a detailed description must be provided. This must also be updated in the event that a new firmware release alters the namespace or adds new nodes/methods/etc.	Absolute	A, B	DVT SAT-T
3.8.7	External sensors: The Contractor shall give information about the type(s) of external sensors to be used with the RTDCE. The installation, maintenance and user manual for the external sensors shall include at least: • Type of cable • Requirements and limitations regarding the sensors • Expected lifetime of the sensors • Installation procedure, including geometry and depth of sensors • Approximate time for installation, and if the road have to closed during installation • Describe any need of special equipment, limitations in weather conditions and other important factors for a successful installation. • Maximum length of feeder cable • Maintenance needed for a long lifetime of sensors	Absolute	A, B	DVT

4. Performance requirements

4.1 Road type

ID	Requirements	Gradation	Part	Test
4.1.1	The RTDCE shall be capable of detecting bicycles on walkways and bicycle tracks. Examples of different road types are shown in Appendix 0.	Absolute	A, B	FAT SAT-T SAT KPI
4.1.2	If the RTDCE is able to detect bicycles on other road types than walkways and bicycle tracks the Contractor must describe where the equipment can be used and what quality (deviation from real numbers of bicycles) is expected.	Wanted funktionality	A, B	DVT FAT
4.1.3	Lane numbering shall follow the description in Appendix A.1.	Absolute	A, B	DVT SAT-T SAT
4.1.4	Contractor shall specify the number of lanes one RTDCE can register traffic on.	Absolute	A, B	DVT SAT-T
4.1.5	The Contractor shall describe minimum and maximum width of one lane.	Absolute	A, B	DVT SAT-T

4.2 Measurements

ID	Requirements	Gradation	Part	Test
4.2.1	The monitoring equipment shall record cyclists who pass the sensors, as described in Table 1 and the OPC UA interface [1].	Absolute	A, B	DVT FAT SAT-T SAT KPI
4.2.2	The RTDCE shall distinguish between the different lanes bicycles are using.	Absolute	A, B	DVT FAT SAT-T SAT KPI
4.2.3	The RTDCE shall distinguish between the directions of the bicycles passing the RTDCE.	Absolute	A, B	DVT FAT SAT-T SAT KPI
4.2.4	Registrations must be timestamped as individual events.	Absolute	A, B	DVT FAT SAT-T SAT KPI
4.2.5	The RTDCE shall capture data with minimum accuracy as specified in Table 1. Other requirements can be given in mini tender competitions.	Minimum	A, B	DVT FAT SAT-T SAT KPI
4.2.6	If other entities (e.g. motor vehicles, suitcases, prams etc.) are recorded, they shall be treated in the monitoring system in such a way that they are not confused with the bicycle registrations.	Absolute	A, B	DVT FAT SAT-T SAT KPI
4.2.7	If optional and other parameters are registered, the Contractor shall give information about the accuracy	Wanted functionality	A, B	DVT FAT SAT-T SAT KPI

4.3 External sensors

ID	Requirements	Gradation	Part	Test
4.3.1	External sensors shall tolerate normal road maintenance such as sweeping, snow-clearing, scattering of gravel and salting.	Absolute	A	DVT FAT KPI
4.3.2	The Contractor shall describe the different type of sensors available to use with the RTDCE	Absolute	A, B	DVT

4.3.3	The Contractor shall describe expected lifetime of sensors	Absolute	A, B	DVT KPI
4.3.4	The Contractor shall describe minimum and maximum width covered with one sensor. If several sensors can be combined in one lane, this solution should also be described.	Absolute	A, B	DVT SAT-T
4.3.5	If one sensor covers more than one lane, describe how the registrations will be split in respective lanes.	Absolute	A, B	DVT SAT-T

5. Options

5.1 Local presentation

This option includes a bicycle display or other local presentation of traffic data. The term "bicycle display" is used in the requirements, but each individual requirement also applies to other forms of local presentation.

ID	Requirements	Gradation	Part	Test
5.1.1	Any equipment for local presentation shall meet the environmental requirements as stated in Chapter 3.3.	Absolute	A	DVT FAT KPI
5.1.2	The bicycle display shall present the total number of cyclists for the current 24-hour period.	Absolute	A	DVT FAT SAT KPI
5.1.3	The bicycle display shall present the total number of cyclists for the current calendar year.	Absolute	A	KPI
5.1.4	The data presented shall be updated in real time.	Absolute	A	DVT FAT SAT KPI
5.1.5	Cyclists in one or both directions shall be able to see their own passing on the bicycle display. Such installations shall be described in a manual.	Wanted functionality	A	
5.1.6	The presentation on the bicycle display shall be clearly visible at a distance of at least 5 metres, irrespective of weather and lighting conditions, to a person with normal eyesight.	Absolute	A	DVT FAT
5.1.7	Communication to bicycle display shall use open and documented communication protocols.	Absolute	A	DVT FAT
5.1.8	The RTDCE shall be an integrated part of the bicycle display if it has to be placed in a cabinet. No additional cabinets are installed at the site.	Absolute	A	DVT FAT
5.1.9	The Contractor shall describe physical dimensions and design of the displays offered.	Absolute	A	DVT

	Requirements on size and design can be introduced in mini tenders, to accommodate for different local requirements.			
5.1.10	All necessary documentation shall be provided, for installation, use and maintenance of the bicycle display.	Absolute	A	

5.2 Antennas

ID	Requirements	Gradation	Part	Test
5.2.1	Units delivered with combined GPS/3G antennas. The GPS/3G antenna must comply with the following specification: • Multi-band GPS + GSM/UMTS • The GPS antenna shall work with the GPS and GLONASS frequencies; 1575.42 MHz and 1602 MHz • The GSM/UMTS antenna shall work with the regular GSM/2G/3G/4G bands; 704-960 MHz and 1710-2620 MHz • IPX7 protection • Centre bolt mount: o Threaded bolt length at minimum 40 mm and maximum 50 mm o Threaded bolt mount with diameter at least the diameter of the RTDCE connector • Puck shaped antenna • Two cables, both at least 2 metres • One cable terminated for GPS of the type SMA (SubMiniature version A, coaxial RF connector), suitable for delivered RTDCE GPS connector • One cable terminated for GSM/UMTS (TNC male, suitable for Cisco 819 router)	Absolute	A	DVT

5.3 Future development road map

Since RTDCE is an area of development NPRA wants to indicate functions which it might want to add in a future mini tender competition. These requirements are not evaluated for the framework agreement. If they are included in a mini tender the functions will be evaluated there. Appart from registration of pedestrian the NPRA can evaluate other functions that the contractor includes in the RTDCE units that add value to the NPRAs data collection.

New hardware or software must be tested and approved by the NPRA before the equipment can be offered in mini tenders.

5.3.1 Registration of pedestrians

The Contractor has the option of including equipment for registration of pedestrians, if this is available as an extension of the RTDCE. Any additional software or hardware needed to register pedestrians shall be described.

ID	Requirements	Gradation	Part	Test
5.3.2	If the RTDCE can record pedestrians who pass the sensors, the namespace and communication shall be as described in the OPC UA interface [1].	Absolute	A, B	DVT SAT-T SAT KPI
5.3.3	Registrations must be clocked as individual passings.	Absolute	A, B	DVT SAT-T SAT KPI
5.3.4	The monitoring equipment shall record pedestrians with high accuracy. The Contractor specifies which accuracy their equipment can meet, with third party tests if available.	Absolute	A, B	DVT FAT SAT-T SAT KPI
5.3.5	The monitoring system shall distinguish between the directions of pedestrians passing the RTDCE.	Absolute	A, B	DVT FAT SAT-T SAT KPI
5.3.6	The RTDCE shall distinguish between the different lanes pedestrians are using.	Absolute	A, B	DVT FAT SAT-T SAT KPI
5.3.7	The Contractor shall inform on which road types it is possible to register pedestrians, and any limitations and requirements to the location of the equipment.	Absolute	A, B	DVT
5.3.8	The equipment shall use the same type of power source as the bicycle equipment.	Absolute	A, B	DVT
5.3.9	Contractor shall provide necessary documentation including installation procedure, guidance in the use and maintenance	Absolute	A, B	DVT

6. Additional documentations and descriptions

6.1.1.1.1.1 Power supply

Descr. A.1 The registration equipment must be attachable to the fixed electrical grid, be attached to a battery, or function with an alternative power supply (e.g. solar panel). The tender must specify the options for attachment to power supplies. The desired type of power supply will be specified in the mini tender competitions.

6.1.1.1.1.2 Data storage and control of data quality

Descr. A.4 The Contractor must describe the quality (deviation between automatic collected traffic data and real numbers of bicycles), with references to documented test results.

6.1.1.1.1.3 Road type

Descr. A.9 The Contractor shall include a description of lane setup. Is it possible to collect data from several lanes, what are the maximum numbers of lanes that can be handled and what is the maximum length of the signal supply cable?

Description of setup to adapt to the principles for lane numbering. State the number of lanes that can be covered with one unit, and specify if the equipment can be put together in modules.

6.1.1.1.1.4 Guidelines

Descr. A.10 An installation procedure and guidelines for the RTDCE

Equipment needed for installation shall be described in the offer. By equipment is meant signal cable, fastening device (if the logger cannot be placed in a roadside cabinet) etc. if needed.

Descr. A.11 A user manual with procedures for verifying configuration and parameter setting for the RTDCE.

Descr. A.12 To ensure that the data coming from the sensors are homogeneous and of good quality, the Contractor shall describe the necessary maintenance procedures for the RTDCE.

Descr. A.13 A system manual that includes sufficient technical description of all equipment intended for use by system administrators in the NPRA.

Descr. A.14 Manuals for sensors and other equipment. They shall include information / manuals with a description of sensors and other equipment from any subcontractors.

Descr. A.15 Contractor shall briefly describe the support being made available for NPRA with regards to skills and availability (local and nationwide). This shall be included in a separate service agreement, which normally is entered during the warranty period.

Appendix

A.1 Principals for lane numbering

In most cases, individual lanes are monitored. Lane codes are used to identify the different lanes, see Figure 3 and Figure 4. These codes specify the position of the lanes across the road. The lanes are numbered from the middle of the road and out to each side. Odd numbers are used for lanes in the metering direction and even numbers for lanes running counter to the metering direction.

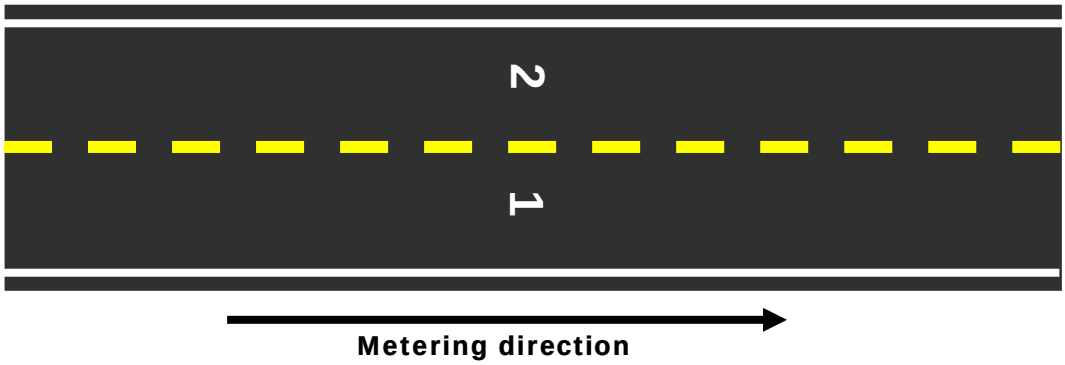

Figure 3. Road type 1: A two lane road.

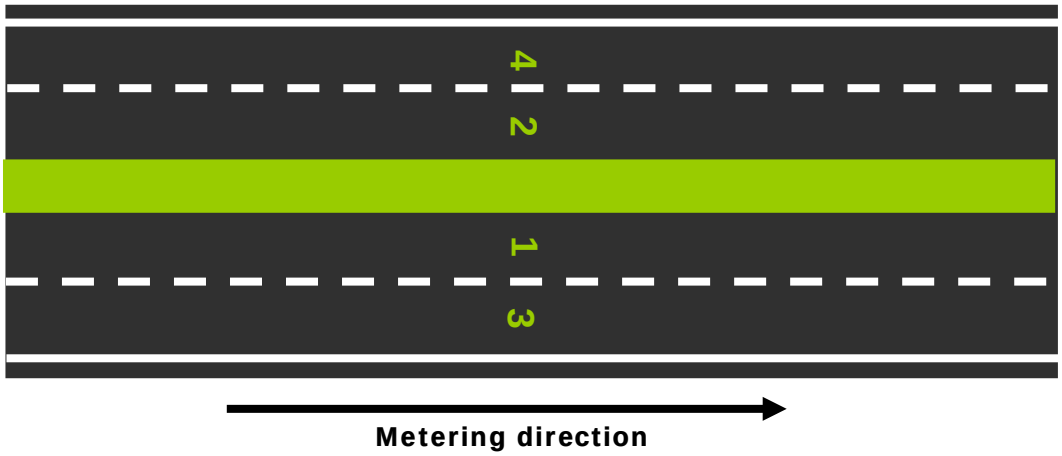

Figure 4. Road type 2: A four lane road.

Special cases

A ramp is handled as a separate road, with independent metering. Turn lanes inherit the metering from the corresponding main road.

A one lane road, were the driving direction is the same as the metering direction, is numbered 1. If the driving direction is counter to the metering direction, it is numbered 2. See also Figure 5.

Narrow roads with one lane and traffic in both directions, as shown in Figure 6, is numbered 1 and 2. Lanes shorter than five meters is not registered as separate lanes, but is included in the main lane.

A lane assigned for special use will have a code behind the number. Bus lanes will have a K (kollektivfelt), and bicycle lanes will have an S (sykkelfelt).

Bicycle traffic on bicycle tracks and sidewalks will be bidirectional.

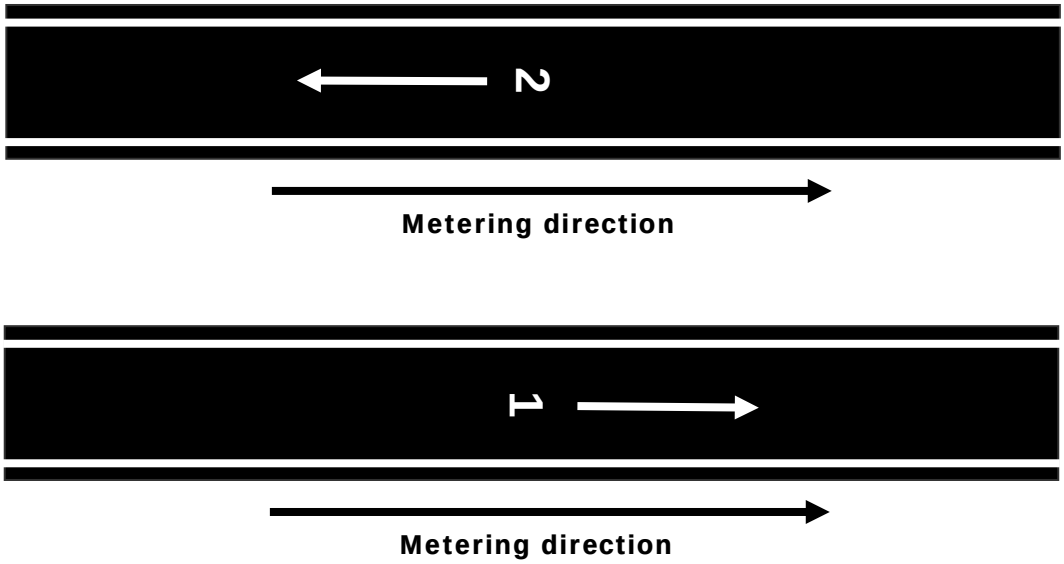

Figure 5 Lane numbers on one lane road

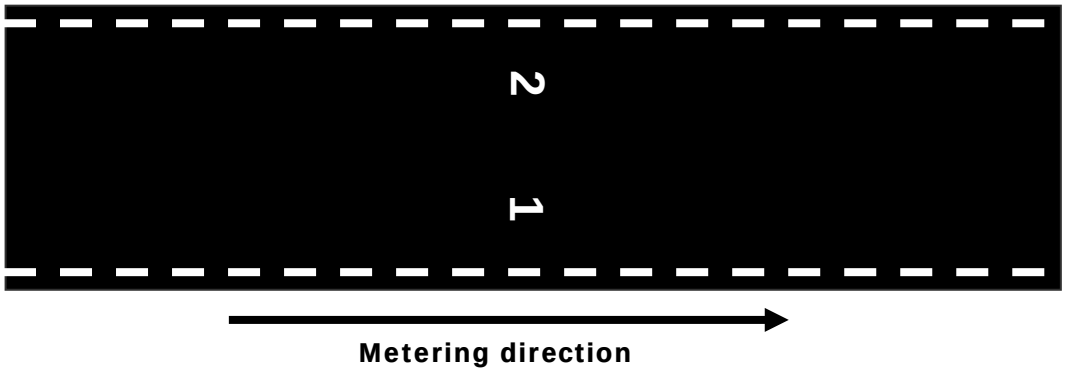

Figure 6 Lane numbers on narrow two lane road

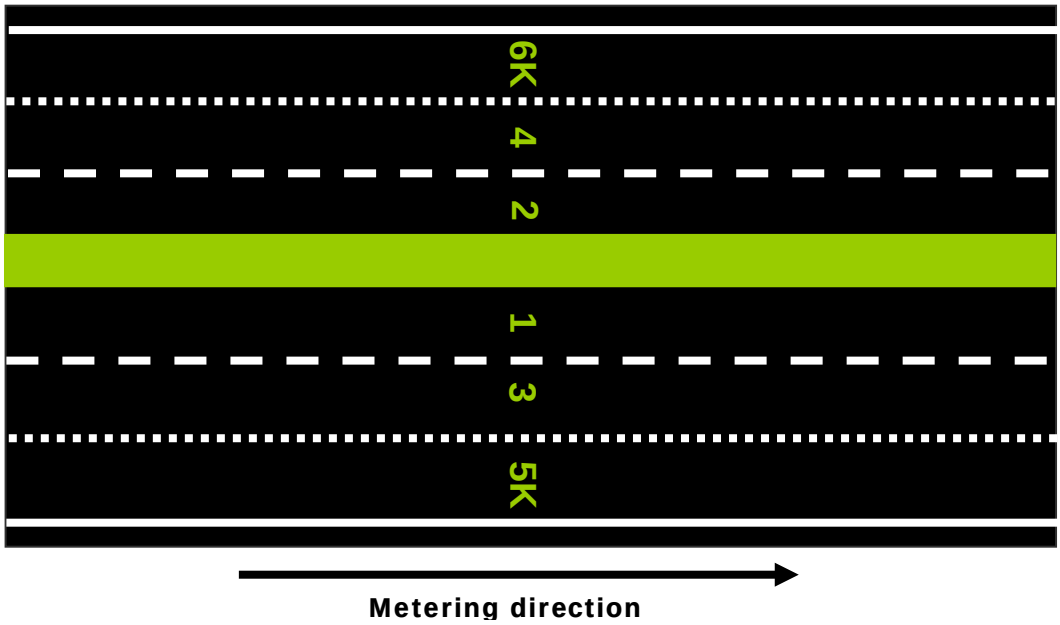

Figure 7 Lane numbers on road with bus lanes in both directions

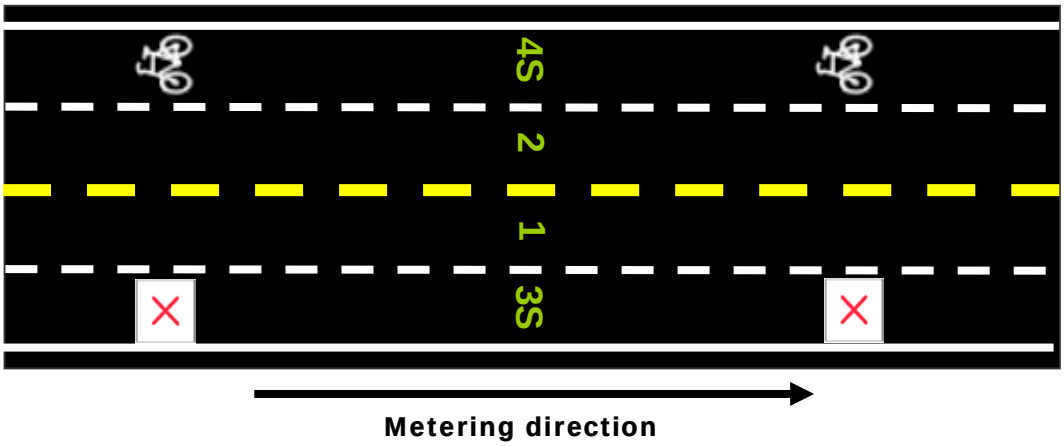

Figure 8 Lane numbers on road with bicycle lane in both directions

A.2 Road types for bicycle registration

The following images show examples of typical bicycle areas.

Figure 9 Walkways

Figure 10 Bicycle tracks with sidewalk

Figure 11 Bicycle lanes

Figure 12 Mixed traffic