



**Request for Proposal**

**CPE Procurement**

**SSA-T / SSA-V, Appendix 1  
Annex 4**

**Operational Requirements**

## Version log

Version	Initials	Date	Comments/amendments
1.0	KIV	18.03.18	
1.1	KIV	11.11.18	Minor corrections
1.2	DIK	18.10.2019	Part of the Tender documents

## Contents

<b>1.</b>	<b>EXTERNAL INTERFACE REQUIREMENTS .....</b>	<b>4</b>
1.1	AutoPASS User-CP .....	4
1.2	Network (TCP/IP) based connections .....	4
1.2.1	Common.....	4
1.2.2	CPE –Toll Charger's Central System (or IP/HUB later) .....	4
1.2.3	CPE – Monitoring and Control System.....	5
1.2.4	Monitoring and Control System – System User.....	5
<b>2.</b>	<b>SYSTEM QUALITY .....</b>	<b>5</b>
2.1	Performance.....	5
2.2	Reliability.....	6
2.2.1	Vehicle Detection.....	6
2.2.2	Electronic Toll Collection .....	6
2.2.3	Vehicle Imaging.....	6
2.2.4	Automatic Number Plate Recognition.....	7
2.2.5	Correlation of OBU and Vehicle .....	8
2.2.6	Clock.....	8
2.3	CP Availability .....	8
2.4	Redundancy .....	9
2.5	Capacity .....	9
2.5.1	Charging Point .....	9
2.5.2	Data Concentrator.....	9
2.5.3	Monitoring and Control System .....	9
<b>3.</b>	<b>ENVIRONMENTAL AND ELECTRICAL REQUIREMENT .....</b>	<b>11</b>
3.1	EMC/EMI .....	11
3.2	Electricity supply/power supply .....	11
3.3	Weather Protected Location (Indoor) .....	11
3.4	Weather Unprotected Location (Outdoor) .....	11
3.5	Other.....	12
<b>4.</b>	<b>MAINTAINABILITY.....</b>	<b>12</b>
4.1	General .....	12
4.2	Local CP Monitoring and Maintenance .....	13
<b>5.</b>	<b>DOCUMENTATION.....</b>	<b>14</b>
5.1	System Design .....	14
5.2	System Operation.....	14
5.3	Service and Maintenance.....	15
5.4	Installation .....	15

1. EXTERNAL INTERFACE REQUIREMENTS

1.1 AutoPASS User-CP

Requirement	
[R 1]	An AutoPASS OBU Customer may be given feedback on passage of CP. It shall be possible to easily switch between MMI(sound) and no signalling, e.g. by adjusting parameters. MMI may be turned on/off at each CP.
[R 2]	Capture of Vehicle Images due to spot test or video flag shall not result in any special indication to the AutoPASS User.

1.2 Network (TCP/IP) based connections

1.2.1 Common

Requirement	
[R 3]	All network connections except within the CP's LAN shall be either: <ul style="list-style-type: none"> <li>• on a Virtual Private Network,</li> <li>• or on secured line if so requested for large Tolling Projects.</li> </ul>
[R 4]	The deliverables should be able to operate with redundant network adapters, e.g. one primary (cable) and one backup (3G/4G). In case of fail-over to backup network, system should provide a notification and such notification should be visible in the monitoring system and also included in periodic reports.

1.2.2 CPE –Toll Charger's Central System (or IP/HUB later)

Requirement	
[R 5]	The CPE shall receive, check and process the Payment Related Data given in Appendix 1 Annex 6: <ul style="list-style-type: none"> <li>• OBU Statusfile</li> <li>• OBU Blacklist</li> <li>• Price file</li> <li>• Image Text File</li> <li>• AIT file</li> </ul> <p><i>Note: Regardless if the files are received from the Toll Charger's Central system or from another source.</i></p>
[R 6]	When new Payment Related Data from the Toll Charger's Central System or another source is made available these shall be in operation at the CP, no later than within 15 minutes.
[R 7]	The CPE shall generate and present to the Toll Charger's CS in accordance with Appendix 1 Annex 6: <ul style="list-style-type: none"> <li>• Vehicle Passage Data: consisting of Passages and if applicable Vehicle Image files.</li> <li>• Exeption messages</li> <li>• Alarms</li> </ul>
[R 8]	New Vehicle Passage Data shall be available for Toll Charger's CS no later than 1 hour and 10 minutes after the data was originally collected. Time shall be configurable.

Requirement	
[R 9]	<p>The CPE shall time synchronise using the Network Time Protocol (NTP) with the following hierarchy (stratum level):</p> <ul style="list-style-type: none"> <li>• Data Concentrator shall be time synchronised to the Toll Charger's Central System,</li> <li>• The CP Master Clock shall be synchronised to the Data Concentrator,</li> <li>• Equipment at the CP shall be synchronised to the CP Master Clock.</li> </ul> <p><i>Note: Should the Toll System only consist of one CP the Data Concentrator may be a part of the equipment located at the CP.</i></p>
[R 10]	Time transferred in Vehicle Passage Data and Exception/Alarm Messages to the Toll Charger's Central System shall be in local time (CET/CEST) and indicating whether it is DST or not.
[R 11]	The CPE shall enable standard file transfer via (s)FTP for transfer between the Toll Charger's Central System and the CPE.

1.2.3 CPE – Monitoring and Control System

Requirement	
[R 12]	The CPE shall continuously be monitored by the Monitoring and Control System.

1.2.4 Monitoring and Control System – System User

Requirement	
[R 13]	<p>The Monitoring and Control System shall allow for that the Toll System can be monitored by the System Users being:</p> <ul style="list-style-type: none"> <li>• The Maintainer</li> <li>• The Customer</li> <li>• The Toll Charger</li> <li>• NPRA</li> </ul>

2. SYSTEM QUALITY

2.1 Performance

Requirement	
[R 14]	The CP shall handle passages with a share of OBU from 0 to 100%.
[R 15]	The CP shall communicate and register compliant OBUs passing at speeds from 0 km/h to at least 140 km/h, when the OBU mounting height is ranging from 0.5m to 2.5m.
[R 16]	The CP shall register Vehicle Image of the vehicle's front and rear vehicle licence plate for vehicle speeds at least from 0 km/h to 140 km/h.
[R 17]	For passages of a AutoPASS OBU Customer, the CP shall via the status light if present give perceivable feedback to the driver for vehicles driving below and up to at least 30% above the maximum allowed speed at the CP.
[R 18]	The CP shall simultaneously for each lane handle the loads given in Table 1.

Table 1 Loads per lane at the Charging Point

Case	Loads
Electronic Toll Collection	10 passages during a period of 5 seconds

	60 passage during a period of one minute
	2300 passages during a period of one hour
	5.000.000 different valid OBUs (OBU Statusfile)
	5.000.000 different invalid OBUs (OBU Blacklist)
Charging by LPR	5 passages during a period of 3.5 seconds
	60 passages during a period of one minute
	2300 passages during a period of one hour

## 2.2 Reliability

### 2.2.1 Vehicle Detection

Requirement	
[R 19]	Vehicles subjected to toll that pass through the Charging Area shall be registered in at least 99.99% of the cases. (i.e. out of 10 000 cases the CP maximum fails to register 1 vehicle).
[R 20]	The probability for the CP to store Vehicle Images without a vehicle or equally sized object being present in the Charging Area shall be less than 0,1 %

### 2.2.2 Electronic Toll Collection

Requirement	
[R 21]	For AutoPASS OBU Customers with a correctly mounted and compliant OBU in accordance with the vendor's specification <sup>1</sup> the read accuracy shall be at least 99.5%. (i.e. out of 1000 cases the CP maximum fails to produce reading of the OBU 5 times).
<i>Note: This include all types of compliant OBUs</i>	

### 2.2.3 Vehicle Imaging

Requirement	
[R 22]	On a monthly basis the images due to vehicle passage's shall for each CP have a quality that ensures that at least 95% of the vehicles subjected to Charging by LPR, are identified.  <i>Note: The requirement is independent of weather, sun position and road conditions.</i>
[R 23]	On a yearly basis the images due to vehicle passage's shall for each CP have a quality that ensures that at least 98% of the vehicles subjected to Charging by LPR, are identified.  <i>Note: The requirement is independent of weather, sun position and road conditions.</i>
[R 24]	The probability of storing a Vehicle Image of a trailer shall be less than 1%.

<sup>1</sup> The OBU shall for most passenger cars be mounted in the centre of the windscreen behind the front mirror and for trucks at the bottom of the windscreen. Excluded are OBU mounted behind the metalized part of the windscreen.

2.2.4 Automatic Number Plate Recognition

Requirement	
[R 25]	<p>For all vehicles subjected to charging by LPR with visible front VLP and rear VLP, belonging to the pre-defined set of recognisable nationalities), the front- and rear ANPR<sub>accepted</sub> shall for each CP:</p> <ul style="list-style-type: none"> <li>Exceed 98 % on average over monthly period and ANPR<sub>error</sub> shall be less than 0.5 %</li> </ul>

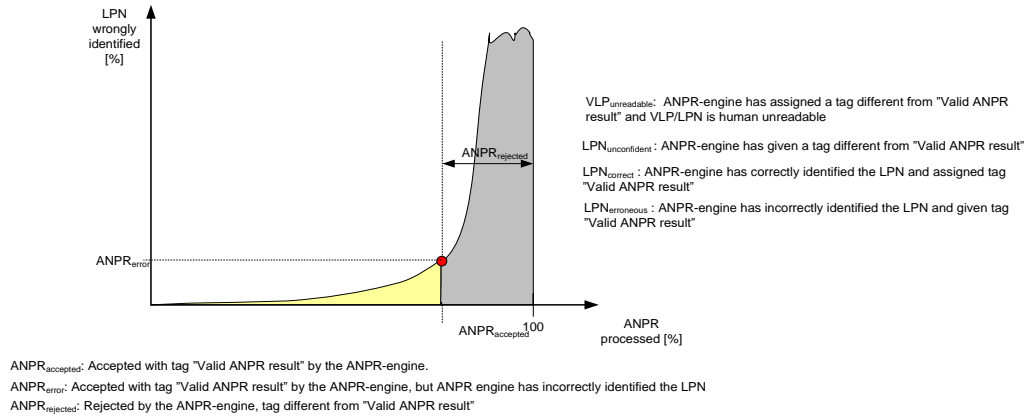


Figure 1 ANPR definitions

In Figure 1 ANPR<sub>accepted</sub>, ANPR<sub>error</sub> and ANPR<sub>rejected</sub> are defined in percentage as follows:

$$ANPR_{accepted} = \frac{\sum LPN_{correct} + \sum LPN_{erroneous}}{\sum LPN_{correct} + \sum LPN_{erroneous} + \sum LPN_{unconfident} + \sum VLP_{unreadable}} * 100$$

$$ANPR_{error} = \frac{\sum LPN_{erroneous}}{\sum LPN_{correct} + \sum LPN_{erroneous}} * 100$$

$$ANPR_{rejected} = \frac{\sum LPN_{unconfident} + \sum VLP_{unreadable}}{\sum LPN_{correct} + \sum LPN_{erroneous} + \sum LPN_{unconfident} + \sum VLP_{unreadable}} * 100$$

2.2.5 **Correlation of OBU and Vehicle**

Requirement	
[R 26]	<p>The AutoPASS OBU Customer’s OBU shall for each CP:</p> <ul style="list-style-type: none"> <li>• be correlated to the AutoPASS OBU Customer’s vehicle with erroneous correlation in less than in 1 of 10 000 cases.</li> <li>• maximum be uncorrelated to the AutoPASS OBU Customer’s vehicle in 1 of 100 cases.</li> </ul> <p><i>Note: Synonyms for correlated are paired or matched. Synonyms for uncorrelated are unpaired or unmatched. The reference between the vehicle and the OBU shall be in the Passage and cross-reference to more than one vehicle from an OBU is not allowed. This implies that then the process at the CP makes the decision of correlating the vehicle and OBU such that the overall result is fulfilled by the requirement. Verification of this requirement will be based on investigations of complaints from the users of the AutoPASS system.</i></p>

2.2.6 **Clock**

Requirement	
[R 27]	If unsuccessful time synchronisation via NTP the maximum deviation of the CP’s master clock shall be less than 5 seconds in a 24 hours period.
[R 28]	Maximum deviation between the clocks at the CP shall be 10 ms.

2.3 **CP Availability**

Requirement	
[R 29]	<p>The design of a CP lane shall give optimal availability.</p> <p>The lane is not available if at least one of the following functions is not operating:</p> <ul style="list-style-type: none"> <li>• OBU reading</li> <li>• Image taking (video system)</li> <li>• Detection system</li> <li>• Data storing of Passages.</li> </ul>



**2.4 Redundancy**

Requirement	
[R 30]	<p>The CPE shall have redundant equipment for each critical function, see [R29] to prevent loss of data and maintain system availability. OBU reading is not regarded as redundancy for image taking and image taking is not redundancy for OBU reading. If one video system (either front or rear) is not in service the system suffer degradation and is defined as not available.</p> <p>Swap time for invoking redundancy equipment is set to maximum 10 minutes.</p> <p>Redundancy is not required for opposite lanes, pedestrian areas and bicycle lanes.</p>

**2.5 Capacity**

**2.5.1 Charging Point**

Requirement	
[R 31]	<p>The CP shall have storage capacity for Vehicle Passage Data (Passages and Vehicle Images) for at least 5 days.</p> <p><i>Note: This is applicable for a share of OBU from 0 to 100% and traffic conditions of up to 2300 vehicle/hour per lane.</i></p>
[R 32]	<p>The CP shall have storage capacity for all logs for 2 years of entries.</p> <p><i>Note: Minimum required logs are given in Section 6.5.</i></p>

**2.5.2 Data Concentrator**

Requirement	
[R 33]	<p>For a Toll System consisting of more than one CP, the Data Concentrator shall have additional capacity so that the Toll System can be extended to in addition minimum handle 100 additional CP.</p> <p><i>Note: This is applicable for a share of OBU from 0 to 100% and traffic conditions of up to 2300 vehicle/hour per lane.</i></p>
[R 34]	<p>If the Contractor installs a communication module/data concentrator for reliable and secure data transfer between Central System and Charging Point, the Customer reserves the right to decide the final location of this data concentrator, but Contractor will be involved in the discussions.</p>

**2.5.3 Monitoring and Control System**

Requirement	
[R 35]	<p>The Monitoring and Control System shall minimum have the capacity given in Table 2.</p>

**Table 2 Monitoring and Control System capacity.**

Item	Value
Minimum Monitoring and Control Centre logging capability. Minimum required logging consists of: <ul style="list-style-type: none"> <li>• log on/off to MCS</li> <li>• Exception Messages</li> <li>• Alarm messages</li> <li>• CP Quality Indicators</li> <li>• Logging of all necessary data to present results for the Key performance indicators, see section 19</li> </ul>	2 years
Response/confirmation to user actions via the MCS's GUI.	3 seconds
Expandable up to supporting up to minimum number of Toll Systems.	10
Expandable up to supporting up to minimum number of Charging Points in the Toll system	150
Expandable up to supporting a minimum number of lanes in the Toll system	400
Minimum simultaneous logged on users on the MCS	20

### 3. ENVIRONMENTAL AND ELECTRICAL REQUIREMENT

#### 3.1 EMC/EMI

Requirement	
[R 36]	The complete CPE shall comply with the EMC directive, 2014/30/EU.

#### 3.2 Electricity supply/power supply

Requirement	
[R 37]	The CP shall connect to utility main Alternating Current (AC) with: <ul style="list-style-type: none"> <li>• IT installation with nominal voltage: 230V or</li> <li>• TN installation with nominal voltage: 400V</li> </ul>
[R 38]	The contractor shall deliver a UPS (function) for the CPE. The UPS shall also restore external main power to the CPE after an external power failure. <ul style="list-style-type: none"> <li>• UPS shall supply the CP with power for minimum 6 hours without reducing the performance of the CP,</li> <li>• Power backup system shall be fully recovered within 6 hours after the utility main power has returned.</li> </ul>
[R 39]	The CP shall have an overvoltage protection and lightning conductor.

#### 3.3 Weather Protected Location (Indoor)

Requirement	
[R 40]	The roadside enclosure components shall operate flawlessly and be in accordance with IEC-60721-3-3, with environmental conditions as specified in Table 3.

**Table 3 Environmental conditions for weather protected Charging Point Equipment.**

Condition	Severity
xHigh/low temperature	3K5
Humidity	3K5
Chemical Active Substance	3C2
Vibration	3M4
Shock	3M4
IEC 60529	IP25

#### 3.4 Weather Unprotected Location (Outdoor)

Requirement	
[R 41]	All outdoor equipment shall be made of corrosion proof material.
[R 42]	The outdoor mounted CPE shall operate flawlessly and be in accordance with IEC-60721-3-4, with environmental conditions as specified in Table 4

Requirement	
[R 43]	<p>The performance of the CP shall not be reduced as a consequence of collection on the equipment or on the road of :</p> <ul style="list-style-type: none"> <li>• Dust, snow, ice or dew, sea water</li> <li>• Mixture of salt, snow and water splashing from the wheels of passing vehicles due to the use of salt to clean away the snow,</li> <li>• Snow being piled up along the road/lane by snowploughs.</li> </ul>
[R 44]	<p>The camera, camera lens or other optical equipment shall be designed such that it does not experience temporary condensation on the inside or on the outside during rapid cooling/change of temperature in the surroundings.</p> <p><i>Note: The outdoor temperature may vary from -40°C in the winter to +35°C in the summer.</i></p>
[R 45]	<p>The outdoor installation shall withstand the wind pressure and vibrations which could be expected at the CP.</p>

**Table 4 Environmental conditions for weather unprotected Charging Point Equipment.**

Condition	Severity
High/low temperature	4K2
Humidity	4K2
Shock	4M4
Vibration	4M4
Mechanical Active Substance	4S2
IEC 60529	IP65

### 3.5 Other

Requirement	
[R 46]	<p>All equipment shall be compliant with European Council Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC.</p>
[R 47]	<p>All equipment shall be compliant with European Council Directive on General Product Safety 2001/95/EC.</p>

## 4. MAINTAINABILITY

### 4.1 General

Requirement	
[R 48]	<p>The outdoor equipment shall at any time of the year be easy to access and clean without any need for disassembling of the equipment.</p>
[R 49]	<p>Replacement of a gantry mounted equipment shall be possible to perform within 1 hour.</p> <p><i>Note: This applies all year around and the 1 hour is applicable from the time when the service personnel has arrived at the CP.</i></p>

**4.2 Local CP Monitoring and Maintenance**

<b>Requirement</b>	
<b>[R 50]</b>	By using a personal computer at the CP it shall be possible to view a subset of the Vehicle Passage Data in real time and of at least for the 100 last Vehicle Passage Data.
<b>[R 51]</b>	The display of the subset of Vehicle Passage Data shall at least consist of: <ul style="list-style-type: none"> <li>• Passage information</li> <li>• Vehicle Images and ANPR results (if applicable for the specific passage),</li> </ul>
<b>[R 52]</b>	It shall be possible to transfer data manually to/from the CP (USB device or similar physical medium, or by use of a portable PC).
<b>[R 53]</b>	It shall be possible to change CP Configuration Data locally at the Charging Point.

## 5. DOCUMENTATION

### 5.1 System Design

Requirement	
[R 54]	The system design shall describe the relationship between the different modules allowing for estimate of amount of equipment and needed work to modify the installation.
[R 55]	The system design shall describe: <ul style="list-style-type: none"> <li>• The communication volume and field strength for DSRC.</li> <li>• The vehicle detectors position and functionality.</li> <li>• The imaging sensor for Vehicle Image's field of view, alignment and timing requirements.</li> <li>• Position of status lights and timing requirements.</li> <li>• Timing diagrams and algorithm for correlation of the vehicle and the OBU.</li> </ul>
[R 56]	The system design shall for all modules specify down to spare part level: <ul style="list-style-type: none"> <li>• Technical functionality and performance.</li> <li>• Operating conditions, temperature, humidity, power supply.</li> <li>• Internal interfaces.</li> <li>• Which SW/HW modules are specially designed or adapted for these works.</li> <li>• Which SW/HW modules are standard products of the Contractor or manufacturer and which are purchased from a third party.</li> <li>• The precautions for disposal with list of any contents that may harm the environment.</li> </ul>
[R 57]	The following interfaces shall be fully documented: <ul style="list-style-type: none"> <li>• Interface for viewing Vehicle Passage Data at the CP,</li> <li>• Interface for Monitoring and Control System.</li> </ul>

### 5.2 System Operation

Requirement	
[R 58]	The operation manual shall describe monitoring of the CPs and how to adjust the CP Configuration Data.
[R 59]	The operation manual shall be written in Norwegian or English and clearly: <ul style="list-style-type: none"> <li>• Describe the procedures for handling Exception Messages and errors.</li> <li>• Describe the procedures for adjusting the CP Configuration Data.</li> <li>• Describe how to view all available logged information on the CP.</li> </ul>

**5.3 Service and Maintenance**

Requirement	
[R 60]	<p>The service and maintenance documentation shall be written in Norwegian or English and:</p> <ul style="list-style-type: none"> <li>• Include all documentation needed for efficient and safe service of the CPE,</li> <li>• Describe the procedures for handling Exception Messages, Alarms and errors.</li> </ul>
[R 61]	<p>The service and maintenance documentation for each CP shall include:</p> <ul style="list-style-type: none"> <li>• A configuration document with the list of configurable parameters and their value,</li> <li>• A “Bill of materials” identifying all parts and modules,</li> <li>• A “Wiring diagram” with all modules identified and showing all connections between them,</li> <li>• Grounding strategy and ground connection diagram,</li> <li>• Drawings with location of equipment and cable ducts.</li> </ul>

**5.4 Installation**

Requirement	
[R 62]	<p>All cables at the CP shall:</p> <ul style="list-style-type: none"> <li>• be clearly labelled for identification on the outside,</li> <li>• have the same identification as on the wiring diagram.</li> </ul>
[R 63]	<p>All equipment shall have unique marking on the outside corresponding to the same identification as on the wiring diagram.</p>
[R 64]	<p>Documentation shall demonstrate compliance to the EMC directive 2014/30/EU.</p>
[R 65]	<p>All installations shall be in accordance to relevant public regulations.</p>
[R 66]	<p>The Contractor installation shall be documented the installation in accordance with Norwegian standards (FebDoc). The FebDoc file must shall be submitted electronically. The document delivery as a part of the SAT.</p>
[R 67]	<p>If the Customer handles the order of the electrical supply, the Customer will deliver a FebDoc file that the Contractor shall calculate on.</p>
[R 68]	<p>The Contractor shall in the tender specify the layout of the toll station within the limitations set by the Customer.</p>
[R 69]	<p>The Contractor shall in the tender for each location, specify the equipment to be mounted in the gantries, including the mounting equipment, weight, dimensions, material, and the number of units and finally a drawing showing the items location on the gantry.</p>