

## **TERMS OF REFERENCE**

**for establishment of component of the video surveillance and pre-arrival information exchange system based on the automated number plate recognition technology at the border crossing point “Criva” within the international technical assistance project “Improving Integrated Border Management along Ukraine-Moldova Border”**

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# **1. List of abbreviations and definitions**

**ANPR/ANPRS – information system for automated number plate recognition at vehicles**

**BCP –border checkpoint**

**CCZ – customs control zone**

**ITA – international technical assistance**

**Datacenter – data processing center**

**DB – database**

**VMS - Video Media Server**

**APM – automated workplace**

## **2. General purpose and nature of the task**

The selected Suppliers are expected to provide equipment, software and services related to establishment of the component of the video surveillance and pre-arrival information exchange system based on the automated number plate recognition technology at the automobile border crossing point “Criva”, at Moldovan side, for the Customs Service of the Republic of Moldova and other agencies (State Border Guard Service of Ukraine, State Customs Service of Ukraine, Border Police of the Republic of Moldova).

The procurement of goods and services is carried out within the framework of the international technical assistance project “Improving Integrated Border Management along Ukraine-Moldova Border”, implemented by the International Organization for Migration and funded by the EU. All relevant activities and results will be under the overall supervision of the MBM Coordinator. Coordination of ongoing activities will be provided by the project team and IOM consultants on implementation of the video surveillance systems.

Within the said ITA project, it’s planned to establish of the technical opportunities for the Customs Service of the Republic of Moldova for automated identification of state registration plates and accounting of vehicles and trailers, which are crossing the BCPs, monitoring of their motion within the BCPs with the possibility of integration into operation processes of the control agencies serving at the BCPs.

Scope:

1. Purchase of video cameras.
2. Installation (on existing metal pillars/posts) and connection to the existing cable infrastructure.
3. Installation of cameras at a height of up to 8 meters, under existing metal canopies and connection to the existing cabling infrastructure. Additional commutation boxes IP65 and mounting plates or brackets may be required to strengthen fastenings within ice and wind conditions, for fastening of cameras on the farms.
4. Installation of cameras at a height of up to 8 meters, on existing lighting poles and canopy supports and connection to the existing cabling infrastructure. Additional commutation boxes IP65 and mounting plates or brackets may be required to strengthen fastenings within ice and wind conditions.
5. Purchase and installation of servers and software (or ready-made solutions from the manufacturer), licenses, switching equipment, equipment for traffic encryption and protection from external connections in accordance with the list (paragraph 5), Appendix #1.1 to this Terms of Reference.
6. Configuring, integrating and commissioning of the system, in accordance with the Concept (paragraph 6) and Requirements to system functionality (paragraph 7).
7. Conducting on-site training for staff (administrators and users of the system) of the Customs Service of the Republic of Moldova and other departments (a training session, not more than two days, not more than 10 trainees - at BCP). A handover activity must be performed in good time before the end of the contract. In this case, all the necessary operational and user documentation, as well as maintenance documentation, is handed over to the client’s personnel (Customs Service of the Republic of Moldova).

## **3. Requirements to the supplier**

A supplier should be able to fulfil the following mandatory requirements:

1. Experience in implementation of video surveillance systems with analytics and supply of equipment for the respective systems (confirmed by the implementation of at least two such projects).
2. Available business structure to provide services, to provide diligent services under a brand, proposed or promoted by supplier at the territory of Moldova (authorization letter or copy of dealer certificate from manufacturer / vendor / authorized representative must be provided).
3. Availability of a service center or support service to provide related services of the brand, proposed or promoted by supplier, and diligent provision of these services on the territory of Moldova (authorization letter or copy of dealer certificate from manufacturer / vendor / authorized representative must be provided).

## 4. Existing infrastructure

Existing infrastructure means the works completed within the existing working project, which implies available communication network for the video surveillance system and the technical conditions created for connection of the video-cameras in the planned installation locations, in accordance with the following requirements:

- Metal trays and cables laid in position;
- Communication network ensures uninterrupted signal transmission from video surveillance cameras through interim controlled switches to the server;
- Fiber-optic cables (with a supporting cable) laid from server to distribution boards for external use, the final connectors mounted in metal trays and by the method of air laying;
- Telecommunication cabinets with uninterruptible power supplies installed as distribution units, pulse and lightning protection modules installed and connected in line with the working project;
- 220 V power supply with grounding supplied to distribution cabinets;
- Communication cables (shielded twisted pair for outdoor use) from the places of probable installation of video cameras to distribution cabinets;
- Open-air networks laid through existing electric poles, building structures and metal canopies using fittings for overhead lines; lining under the canopies and inside the premises was done in metal trays.

## 5. Procurement list (software, equipment and services)

The tender foresees the purchase of equipment and software, connection of the aforementioned equipment to the existing infrastructure, set-up and start-up of the system, training of the personnel.

A brief list of hardware and software is provided below. Detailed requirements for equipment are given in Appendix # 1.1 to this Terms of Reference. The Bidder is expected to separately indicate in the proposal the cost of each type of equipment, software and services for each Project.

№	Type	Quantity, Criva BCP
<b>Equipment</b>		
1	SAN / DAS storage for uninterrupted storage of video from surveillance cameras at least 90 days, automatic backup of records older than 24 hours from fast SSD disks to slower SAS disks, work with both servers through direct connection of 16Gbs interface, duplication of main controller and power unit, WEB interface for configuring	1
2	Database server, WEB, CMS for processing of videostream, (record/demonstration/processing), automatic recognition of number plates via 36 channels, with constant duplication, with possibility to continue working in case of failure of one of the servers, storage on an external SAN server	2
3	Number plate recognition camera	20
4	Surveillance camera	6
5	Network firewall Fortinet FortiGate-60F, or equivalent	1
6	48-port 10/100 PoE Managed switch	2
7	24-port 10/100/1000 PoE Managed switch	2
8	FTP/UTP Patch-cord, 0.5m, Cat5e	100
9	FTP/UTP Patch-cord 1GbE, 1m, Cat6e	50
10	FC Patch-cord, 1.5m, 16Gbs	20
11	10GbE DAC cable 3m for ethernet switches	4

When performing architectural and engineering works, it is necessary to provide for the final solution for each BCP envisaging at least 10 free ports therefore allowing further modernization of video surveillance system in context of installing additional cameras.

## 6. Concept of the system operation

The concept of establishing the systems in these projects is based on usage of server equipment in its main tasks, and the separately protected data storage system with disk array. Cameras won't perform any analytical functions and all analytical tasks will be carried out centrally on the server platform and installed software.

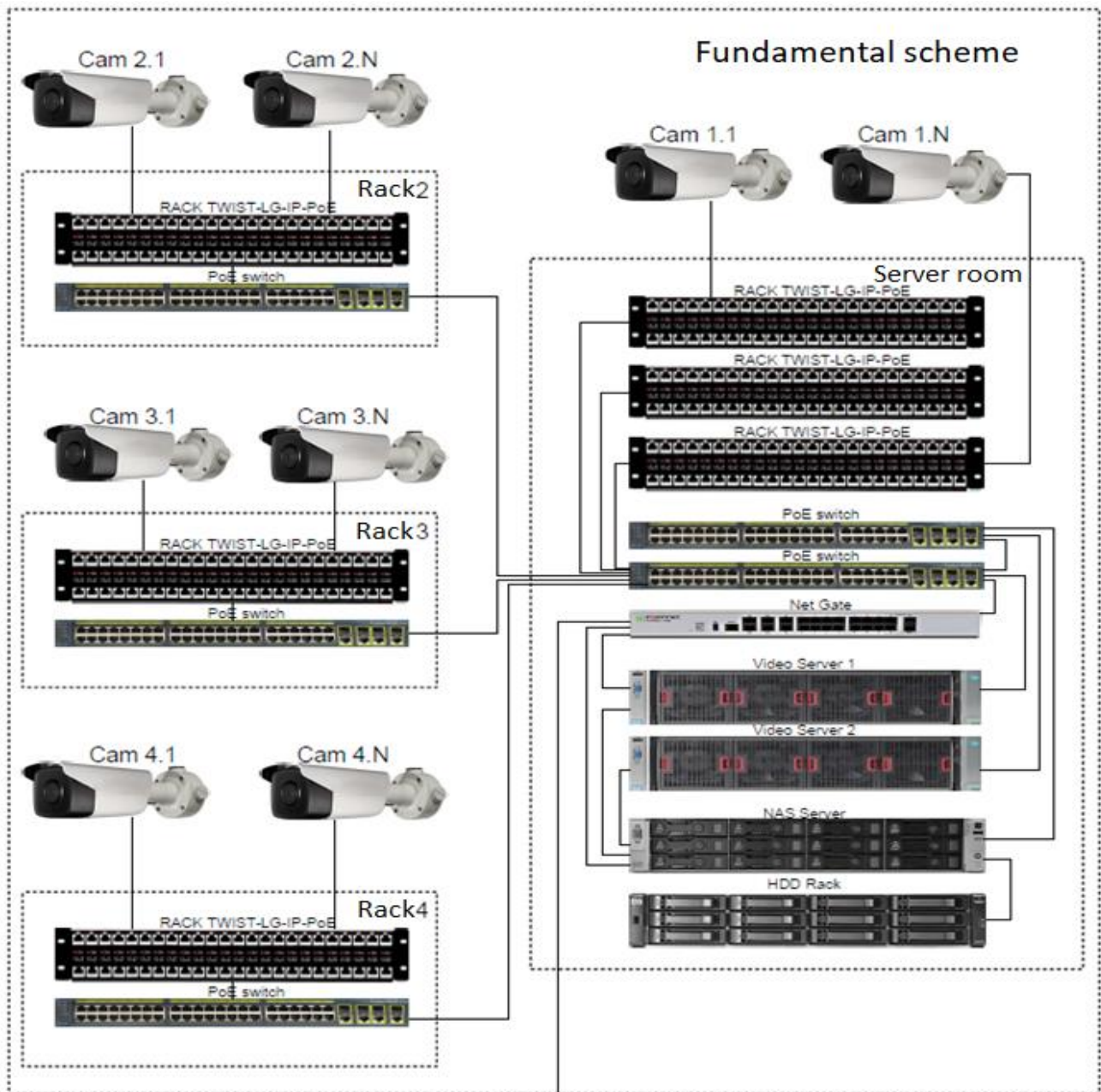
The main objective of the component of video surveillance and pre-arrival information exchange system at the BCP is to create technical possibilities to control movement of goods and commercial vehicles within the BCP in real time mode through:

- reading and recognizing number plates of vehicles upon entry/exit to/from BCP and during movement of vehicle within the BCP;
- photo and video recording of vehicle;
- video recording of customs formalities at CCZ of the BCP;
- structuring video analytics system in line with the preliminary scenarios of alarms at different zones of the BCP;
- minimization of "human" factor due to possibilities of the state-of-art soft-and-hardware systems, documentation of actions.

Also, the tasks of the component of video surveillance and pre-arrival information exchange system at the BCP are as follows:

- establishment of preconditions for operative and convenient remote control of work of personnel of services;
- detection and analysis of offences at the BCP in comparison with the established settings and procedures, using the corresponding video data;
- possibility to control vehicle during all stages of customs formalities carried out at the BCP;
- creation of the technical possibility, having communication channels and database in place, for integration with other databases and exchange with meta/analytical data;
- extending bandwidth of the BCP due to optimization and automatization of separate processes of BCP operation;
- possibility to monitor the status of system components (video cameras, servers and switching equipment).

Video flows from cameras (without changing, processing or analyzing) through switches are routed to video surveillance servers. If the channel is for automated number plate recognition, then the channel runs software of ANPR module: the key snapshots of maximum quality are automatically identified for recognition, resulting in transfer of snapshot and metadata into database. Video from the cameras isn't recorded and saved. All other channels accept video flows from cameras, record videoflows into archive and if needed, process videoflow through in-built software analytics. All external connections to video surveillance system are possible under control of firewall and servers.



**CONNECTING EXTERNAL CLIENTS  
at the BCP or by Internet**

To effectively perform main tasks, allocation of video cameras by functionality was provided. Inter alia, the videocameras are listed below:

- surveillance at the CCZ beyond premises of the BCP;
- surveillance of the perimeter territory of the BCP;
- ANPR/ANPRS for recognition of number plates of vehicles;

The cameras installed at CCZ must provide for possibility to record customs formalities on the spots and to form respective archive as well as provide for possibility to remote control.

Minimal archive depth for the said cameras is not less than 30 days (25 f/s, quality 720p).

Installation of cameras in all areas of the BCP will provide control over movement of vehicles though reading and recognizing license plates of vehicles and trailers / semi-trailers at entrance and exit to / from controlled areas and when vehicles are crossing controlled area. The exchange of metadata and photos of vehicles is provided for processing and providing results to the operator. Minimal archive depth for ANPR cameras is at least 30 days.

Analytical information (photos covering all benchmarks of vehicle crossing the controlled area, recognized number plate and type of the vehicle (and trailer/ semi-trailer if available), country of vehicle's registration, time of crossing of the identified zones, duration of stay of the vehicle on the territory) should be stored on the servers of the UACS not less than 12 months. Videoflow won't be saved in this case.

Case = entrance to the BCP + customs control zones (CCZ) + exit from the BCP = linking to video flows.

Installation of surveillance cameras with analytical functions on the BCP perimeter will simplify the work of agencies in terms of controlling the territory, will allow for the analytical monitoring and recording inside and outside BCP perimeter during daytime and night, and whenever possible in poor light or foggy conditions. Having analytical information from surveillance cameras will greatly simplify the perception of video information.

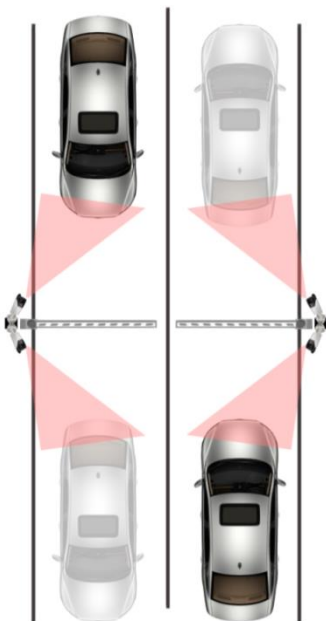
All cameras are connected by direct cable using PoE technology to the switches. Switches that are powered from uninterrupted power supplies (supplied beyond of the scope of this tender) will allow the system to work without interruption even in case of a power supply system failure at the BCP. The location of the cameras on the facility implies that the distance from the cameras to the switches is not more than 100m, this distance can be extended up to 30% if the camera power consumption is not more than 50% of the maximum power on the designated switch channel.

All video streams are routed through remote switches to the central switch located in the server room, which can only be accessed by the Customs Service of the Republic of Moldova service team. Through the network firewall installed in the server room, the video streams are transmitted to other agencies for further processing on their part through the network firewalls.

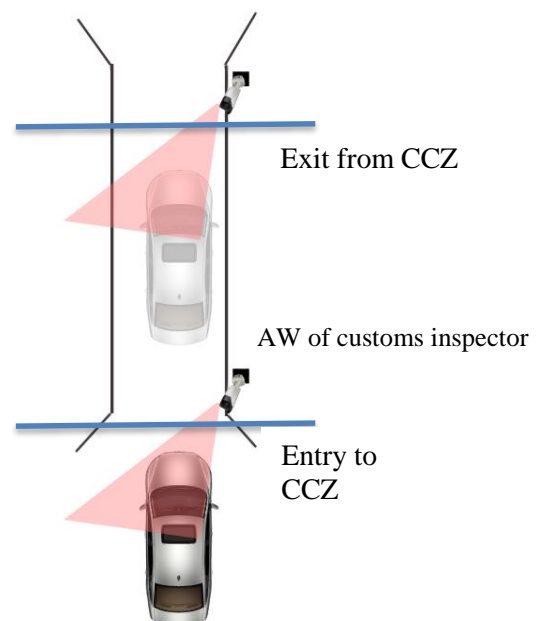
Thus, the entire video surveillance system and analytics is owned by the Customs Service of the Republic of Moldova, and at the same time has the ability to transmit open information to other agencies through network firewalls, preventing unauthorized leakage of the information.

### Installation configuration for vehicle number plate recognition cameras as per the project:

a) BCP entry and exit zones



б) control areas (CCZ)



To ensure uninterrupted operation of the meta / analytic data server, the architecture of the installation of an additional server with physical backup is envisioned. The analytics server operates in the normal mode, but when it fails, the functionality is automatically switched over to the backup server.



To calculate the depth of the archive, the following data were considered as a basis: recording 10 f/s 1080p, speed 1500-2000kbit / s, high intensity image.

	Quantity of cameras	H.264	H.264+	H.265	H.265+
<b>Criva, 30 days</b>					
Surveillance cameras	20	38 Tb	30 Tb	24 Tb	20 Tb

The video stream from cameras must be shared with other agencies in the following ways:

- connection of the operator to a remote workplace (AW) with a legislatively defined minimum amount of data transmission. In this case, mode of use of the archive is carried out according to interagency agreements in a manner prescribed by legislation.
- supply of the software must include not less than 5 workplaces and the cost of each additional workplace must be stipulated (if applicable).
- video streaming through a gateway, with a limitation of a video flow. Purchase of additional video stream processing servers from the receiving side is beyond the scope of this project.

## 7. Requirements to system functionality and establishment (integration)

**This paragraph contains a summary of the requirements for the development and integration works to be carried out by the Contractor. The expected deliverables are also outlined.**

### Steps of crossing through the BCP at Ukraine – Moldova border by a vehicle

**Step 1.** Vehicle is before entering the territory of BCP, at the area controlled by the cameras.

1. When the vehicle is located in front of entrance to the territory of the BCP, the front camera is activated. Number plates are identified by the front ANPR camera.
2. Basic algorithm\*: information is transmitted to the VMS system (Video Media Server, streaming video service), further transmitted to the system of automatic number plate recognition – ANPR to form a unique case resulting in - photo of vehicle and number plate.

If recognition was correct, Vehicle Case for border crossing (hereinafter– Case) is created and video is deleted, in case of recognition failure an alarm event is created, and license plate number is manually adjusted, and the Case is completed.

User identification at AW is carried out with a login and password. To foresee further development of the system in the context of introduction of additional methods of authorization, inter alia using reader for credentials of officials of the Customs Service of the Republic of Moldova. Further, video is removed.

Content of Case

Entry 1: photo of vehicle in front of BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera. Data available for transmission from information exchange software to integration module through API.

**Step 2.** Vehicle at the territory of BCP.

1. Vehicle is moving at the territory of BCP, upon passing a barrier, rear view camera identifies rear license plate number; license plate number is transmitted through VMS video server, further through ANPR.
2. Data complement existing Case.

Content of Case

- entry 1: photo of vehicle in front of BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
  - entry 2: photo of vehicle upon entry to BCP, recognized/ manually adjusted through AW number of rear license plate, timestamp, number of camera.
3. Data available for transmission from information exchange software to integration module through API.

**Step 3.** Vehicle is at the entry to the CCZ.

1. Vehicle is at the entry to the CCZ.
2. Vehicle is at the entry to the CCZ.

3. Validation of Case. Verification of quality of recognized rear license number plate is performed. If rear number was recognized incorrectly upon movement of vehicle, adjustment is done at AW (identification algorithm is as above).

Content of Case:

- entry 1: photo of vehicle in front of BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 2: photo of vehicle upon entry to BCP, recognized/ manually adjusted through AW number of rear license plate, timestamp, number of camera.
- entry 3: photo of vehicle upon entry to controlled area, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.

4. Data available for transmission from information exchange software to integration module through API.

**Step 4.** Vehicle is exiting the CCZ.

1. Front license plate is recognized when vehicle is exiting the controlled area.

2. Basic algorithm is performed.

3. Existing Case is supplemented with data.

Content of Case:

- entry 1: photo of vehicle in front of BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 2: photo of vehicle upon entry to BCP, recognized/ manually adjusted through AW number of rear license plate, timestamp, number of camera.
- entry 3: photo of vehicle upon entry to controlled area, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 4: photo of vehicle when exiting controlled area, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.

4. Data available for transmission from information exchange software to integration module through API.

**Step 5.** Vehicle is exiting BCP.

1. Vehicle is near a barrier upon exit from BCP, ANPR identifies front license plate.

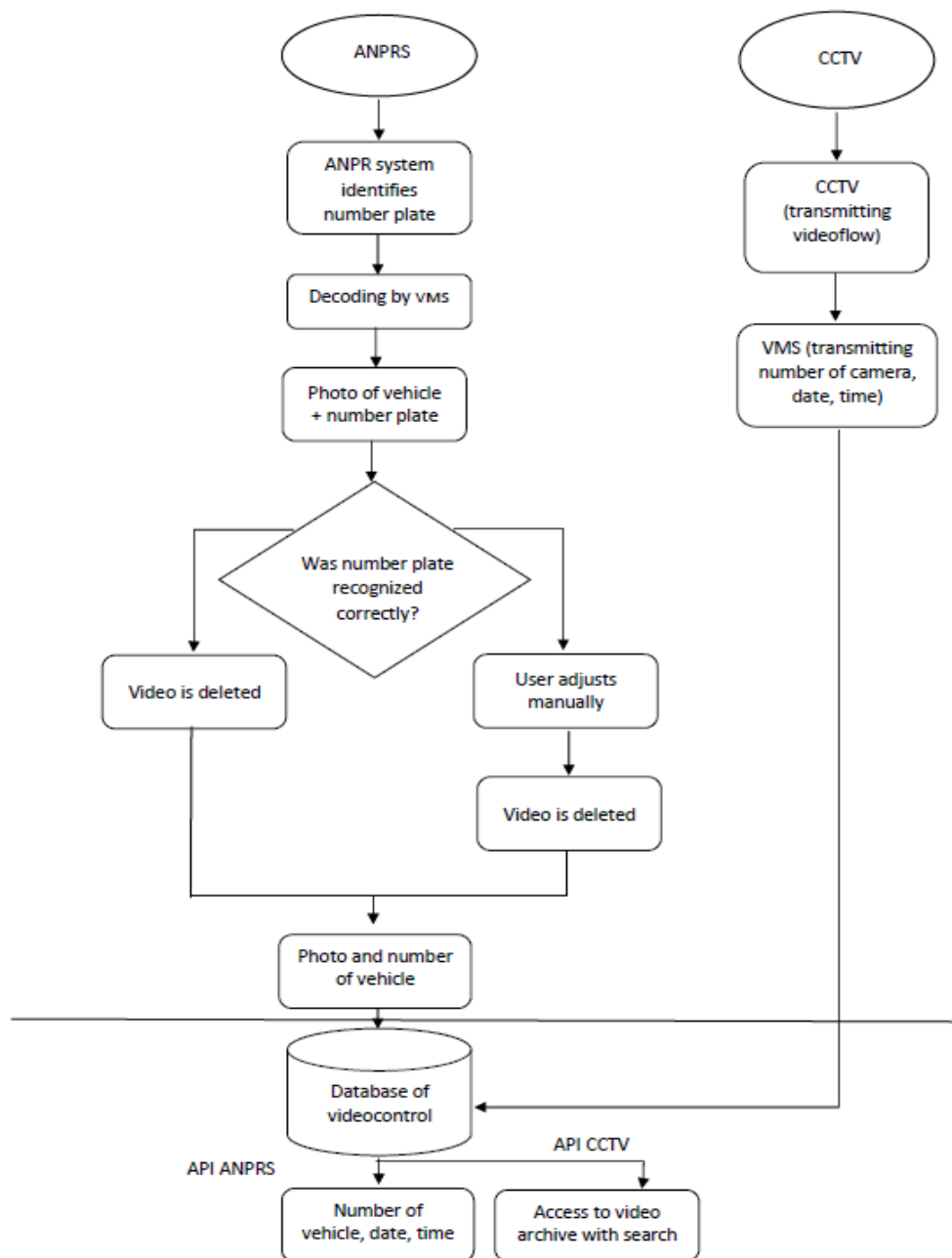
2. When barrier is lifted up, vehicle exits BCP, ANPR identifies rear license plate.

3. Case is closed.

Content of Case:

- entry 1: photo of vehicle in front of BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 2: photo of vehicle upon entry to BCP, recognized/ manually adjusted through AW number of rear license plate, timestamp, number of camera.
- entry 3: photo of vehicle upon entry to controlled area, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 4: photo of vehicle when exiting controlled area, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 5: photo of vehicle when exiting BCP, recognized/ manually adjusted through AW number of front license plate, timestamp, number of camera.
- entry 6: photo of vehicle after exit from BCP, recognized/ manually adjusted through AW number of rear license plate, timestamp, number of camera.

\*\* Note. Functioning of barriers and other components of a traffic management system is out of this procurement. Barrier operation data must be available through the API.



### Basic algorithm of operation of video surveillance system

Data from ANPR cameras are transmitted to AW at BCP for validation by the operator. If the data is recognized correctly, video of the fragment is deleted. If the recognition failed, operator must be able to enter correct data using, inter alia, video from ANPR camera. After license plate is identified, video is deleted, leaving a photo of vehicle license number, time and date. In parallel, video surveillance is ensured with CCTV cameras, recording into video archives. Data from the database are available for the services according to the assignment policy.

### Requirements to the system

Control of movement of vehicles across the controlled areas (control of vehicles undergoing stages of customs formalities at the areas of control), namely:

- entrance to the territory;
- weighing;
- scanning;
- customs control and clearance;

- vehicle inspection in in-depth inspection zones;
- time spent on the territory;
- exit from the territory.

\* control of stages is carried out by recognition of number plate of vehicle and video recording by surveillance video camera (CCTV) with possibility of search in video/photo archive.

Equipment of video surveillance system must provide for:

- recording video information into archive from all available video streams upon presence of motion and at a speed of at least 25 fps (frames per second) and with a resolution of at least 720p for each video stream;
- storage of video information in archive at the regional level for surveillance cameras in the areas of customs formalities - not less than 30 days;
- storage of video information in archive at the regional level for surveillance cameras that provide for regime of the customs control zone - not less than 30 days;
- storage of information on procedure for motion vehicles in the controlled area - for at least 12 months in the video surveillance database.

Points and tools of control:

- cameras at the entrance to the territory of the BCP;
- cameras in the customs control zones;
- surveillance cameras on the territory and at the perimeter of the BCP;
- cameras at the exit from the territory of BCP.

Video surveillance system must provide:

- streaming video surveillance and archiving of data on the vehicles and persons crossing the border;
- work with archive, search by camera, time, events, reactions, deviations and other metadata.
- possibility to work with lists of vehicles with restrictions on crossing of the state border. To inform the operator in case such vehicle is detected at the BCP. It must be possible to upload the lists into the system using the API.

### **System security**

- each user has a separate ID (login);
- logging of all actions in the system.

The Customs Service of the Republic of Moldova must be able to provide to other agencies the information on video monitoring of the perimeter and the internal territory of the BCP, in particular: real-time video surveillance, archiving, searching in archive by time / camera / event / licence plate number.

### **Interaction of the system with different agencies**

In order to setup the interconnection of the video surveillance system with the agencies, in accordance with the security requirements, routers will be installed at the exit of each service's information and telecommunication system, which will restrict access to video surveillance data. Within the architecture of the video surveillance system, it is necessary to provide for the use of the archive through routing with complete logging of user actions. System administrators assign access rights of each agency. Users of other agencies should not be able to make changes to the integrity of the system data.

In the video surveillance and analytics system, it is necessary to reserve the possibility of providing users with access to video data and vehicle database of Cases at the BCP, analytics data and an archive with a set depth, depending on the type of user.

It's necessary to provide for the possibility of secure data exchange using a firewall.

### **Separation of tasks of a video surveillance system and analytics**

- control of vehicles within controlled areas in a real-time mode;

- availability of analytical functions: control over movement of vehicle in the controlled areas more than once in the last 24 hours, control of time spent in the controlled area;
- data transfer to data storage and application servers;
- identification and recognition of all types of license plates of vehicles of Moldova, including two-line and all types of license plates of European and CIS countries;
- identification and recognition of license plates of vehicles within the range of speeds between 2 and 30 km / h.
- probability of recognition of not less than 95 percent provided that the license plate number complies with the requirements of the Vienna Convention on Road Traffic dd November 8, 1968;
- transmission of data of identified license plates of vehicles, as well as photos of license plates and photos and videos of vehicles to the servers of data storage and archiving;
- use of Onvif or RTSP protocols (without password and login);
- support of interaction with third party devices;
- storage in own database of information on date / time of identification of license number plate, recognized front / rear number plates in text form, photos of front / rear number plates, photo of vehicle, front / rear view, country of registration of vehicle;
- architecture of the solution must include the use of virtualization (Hyper-V, VMware or equivalents).

## **Software**

Software (software) must be cross-platform, be able to access system data through a web application, work in any accessible environment (Windows, Unix, Linux, Mac OS, Android, iOS).

### **Requirements to software of VMS server:**

The video surveillance server software must be compatible with server OS, have a WEB interface for remote configuration and have a remote client module for different operating systems. Software shall be licensed without term limitations.

Specification of requirements to functionality of video surveillance system software:

- software operation in the main / backup server mode with server load balance depending on the system status, automatic balancing of load and functions between the two servers, interaction with server OS to increase control and system reliability;
- up to 128 cameras for simultaneous viewing / recording / playback with a quality of 1080p 25k/s, support of OnVIF protocols (PROFILE S, G);
- transmission of the videostream from the selected cameras for external processing of video by third-party means according to the OnVIF protocol, settings of cross or compressed streams (processed);
- up to 36 channels from ANPR at BCP. Recognition of numbers of the EU, the CIS, the countries of the Middle East. Determination of numbers with a probability of at least 98% at speeds up to 20 km /h.;
- maintaining a database with transport metadata with recognized numbers, time of crossing at control points;
- maintaining a database of events (ANPR, line crossing, area violation, etc.), individual settings of each channel for individual events and reactions to them;
- control over operation of the system, ensuring reliability of all software modules, control over integrity of the video database, auto-recovery of modules in case of their failure;
- administration of the software through the Web interface and SMTP, constant informing of the selected operators about the system and its failures.

### **Requirements to system reliability and integrity**

Network switches for cameras must be placed in secure cabinets (the installation of the cabinets will be performed beyond of the scope of this tender), in places accessible for servicing and with visual observation of them by customs or border guard service personnel. All PoE network switches for cameras must be provided with an uninterrupted power supply unit (UPS) with a working time of at least 10 minutes at maximum load (installation of the uninterrupted power supply units into the cabinets will be performed beyond of the scope of this tender).

All stationary cameras must be connected to switches with a cable using the PoE standard.

Connecting cameras to the switches must be performed through impulse and lightning protection devices (the installation of protective devices will be carried out outside of the scope of this tender), with PoE standard support.

## 8. Terms of delivery of equipment and software, processing of services

The delivery of hardware, software and licenses, as well as the provision of services, is carried out in accordance with the schedule in the table below.

The timetable below is to only to be seen as indicative. Tender participants shall provide a specified delivery and performance plan as part of their bid.

Stage	Expected result	Performance timeline
Stage #1. Connection of cameras and system setup	<ul style="list-style-type: none"> <li>• Visit the border crossing points for work planning.</li> <li>• Agreed plan of system deployment.</li> <li>• Deploying the system, installing and connecting equipment.</li> </ul>	8 weeks after signing the contract
Stage #2. System startup, system testing, staff training	<ul style="list-style-type: none"> <li>• Signing the protocol, based on the results of the system tests.</li> <li>• Provision of instructions for the officials of the Customs Service of the Republic of Moldova and other agencies on the use of equipment and software.</li> <li>• Vendor-provided training of the officials of the Customs Service of the Republic of Moldova and other agencies on how to use the system.</li> </ul>	6 weeks after signing the contract

## 9. Appendix #1.1: Equipment list and requirements

#	Type	Quantity, Criva BCP
<b>Equipment</b>		
1	<p><b>HDD storage (storage and server must be from the same manufacturer):</b></p> <ul style="list-style-type: none"> <li>- 2 controllers with possibility of hot swapping (active-active);</li> <li>- 24GB of memory per array;</li> <li>- Storage 2x1.92GB SSD SAS Read Intensive 12Gbps 512 2.5in Hot-plug AG Drive;</li> <li>- Support for SAS and NL-SAS, compatibility with different types in one system:               <ul style="list-style-type: none"> <li>o NL-SAS (7200 rpm, 3.5-inch): up to 18 TB;</li> <li>o SAS (10,000 rpm): up to 2.4 TB;</li> <li>o SSD-drives: up to 3.84 TB;</li> </ul> </li> <li>- I/O port with 4x 16Gbps FC ports for each controller;</li> <li>- Support for direct connection to 4 servers in high availability mode in two ways;</li> <li>- SFP Module 4pcs. SFP Fiber Channel 16 Gbps;</li> <li>- Cable 4pcs. multi-mode fiber cable LC-LC 2 meters;</li> <li>- Automated storage up to 3 main levels, support for two-level storage;</li> <li>- Support RAID RAID 0, 1, 5, 6, 10, 50 or other advanced data protection, a combination of different RAID levels;</li> <li>- Snapshots Maximum number of snapshots per array 256;</li> <li>- AC Power Supply 580W, Redundant, Flex;</li> <li>- Extended disk storage unit for min 8 drive enclosures (either LFF and/or SFF);</li> </ul>	1
	<ul style="list-style-type: none"> <li>- Hard drives 9pcs. 16TB NLSAS 12Gbps 512e 3.5in Hot-plug Hard Drive;</li> </ul>	9
	<ul style="list-style-type: none"> <li>- 60-month warranty; next business day service (NBD)</li> </ul>	
2	<p><b>Server for processing and recording video streams (storage and server must be from the same manufacturer):</b></p> <ul style="list-style-type: none"> <li>- Chassis with 2 and more 2.5 "Hot Plug Hard Drives (2CPU &amp; XGMI);</li> <li>- Processor 2 pcs. 16 cores with a frequency of at least 2.9GHz, 22M Cache;</li> <li>- Hardware encryption Trusted Platform Module 2.0;</li> <li>- RAM 64GB RDIMM, 3200MT/s;</li> <li>- Storage 2pcs 480GB SSD SATA Read Intensive 6Gbps 512e 2.5in Hot Plug S4510 Drive, 1 DWPD, 876TBW; in RAID1</li> <li>- Ports 4 x 1GbE, 2 x 16Gb Fiber Channel HBA;</li> <li>- Indoor module SD 32GB microSDHC / SDXC Card (SD card included);</li> <li>- PCI Config expansion slots PCIe 3.0;</li> <li>- Power supply 2 x 800 W;               <ul style="list-style-type: none"> <li>- Graphics option: NVIDIA Quadro RTX 6000 Graphics Accelerator Meets equipment requirements. ANPR and VMS, compatible with the proposed solution.</li> </ul> </li> </ul>	2
3	<p><b>Camera for number plate recognition with bracket (supplier is responsible for selection of bracket and mounting box)</b></p> <p>Matrix 1 / 2.9" Progressive Scan CMOS; Sensitivity in color (Lk) 0.01; Varifocal lens 4 - 9 mm; Focusing is manual, with fixing; Day / night ICR filter; IR illumination range, m 30; Main and additional flows 1920x1080 - 25k / s; Hardware image enhancement mode WDR, DNR noise reduction, ROI quality selection; H.265, H.265 + video compression standard; Network interface 1 RJ45 10 / 100Mb; ONVIF network functions (PROFILE S, G); Street type with built-in heating;</p> <p>Universal bracket (mounting on a rectangular column, vertical surface); Operating temperature conditions -30 ° C ~ + 60 ° C; PoE + power supply; Protection IP67, IK10; Warranty at least 12 months, (preferably 36 months)</p>	20

5	<p><b>Surveillance camera with bracket (supplier is responsible for selection of bracket and mounting box)</b></p> <p>Matrix 1 / 2.9” Progressive Scan CMOS; Sensitivity in color / bw (Lk) 0.01 / 0,001; Lens Varifocal 2.8 - 9 mm; Focusing Automatic, manual, with fixation; Day / night ICR filter; IR illumination range, m 50; Main and additional flows 1920x1080 - 25k / s; Hardware image enhancement mode WDR, DNR noise reduction, ROI quality selection; H.265, H.265 + video compression standard; Network interface 1 RJ45 10 / 100Mb; ONVIF network functions (PROFILE S, G); Street type with built-in heating; Universal bracket (mounting on a rectangular or round pole, vertical surface or ceiling) with mounting box; Operating temperature conditions -30 ° C + 60 ° C; PoE + power supply; Protection IP67, IK10; Warranty at least 12 months, (preferably 36 months)</p>	6
6	<p>Network firewall <b>Fortinet FortiGate-60F</b>, or equivalent 8 GE ports for RJ45 switching; 2 ports GE WAN RJ45 connections; full bandwidth 10 Gbps; full VPN bandwidth 6 Gbps; full SSL VPN bandwidth 900 Mbps; Functions Switch / Firewall / IPsec and SSL VPN / WAN / Traffic shaping / NAC + BYOD / DLP; Warranty 36 months</p>	1
7	<p><b>48-port 10/100/1000 PoE Managed switch</b> 48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); 4 SFP+ 1/10GbE ports; Switching capacity min 120 Gbps MAC address table size 16000 entries PoE power 370 W; Maximum power rating 500W Layer 2 switch (VLAN support and tagging, etc.) with Layer 3 routing (Static IP routing, RIP) 60-month warranty; next business day service (NBD)</p>	2
8	<p><b>24-port 10/100/1000 PoE Managed switch</b> 24 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); 4 SFP+ 1/10GbE ports; Switching capacity min 120 Gbps MAC address table size 16000 entries PoE power 370 W; Maximum power rating 500W Layer 2 switch (VLAN support and tagging, etc.) with Layer 3 routing (Static IP routing, RIP)</p>	2
9	FTP/UTP Patch-cord, 0.5m, Cat5e	100
10	FTP/UTP Patch-cord 1GbE, 1m, Cat6e	50
11	FC Patch-cord, 1.5m, 16Gbs	20
12	10GbE DAC cable 3m for ethernet switches	4



## 10. Appendix #1.2: The structure schemes for the BCP

