



# SAFETY PERIMETER & ALERTING SYSTEM



# GOALS OF SPAS IMPLEMENTATION



## Enhancing safety level

- Eliminating the human factor in the signaling function
- Improving the reliability of informing crews about the approach of rolling stock
- Enhancing the quality of notifications



## Enhancing economic efficiency

Replacing the human role of a signaller



# SPAS SYSTEM FUNCTIONS

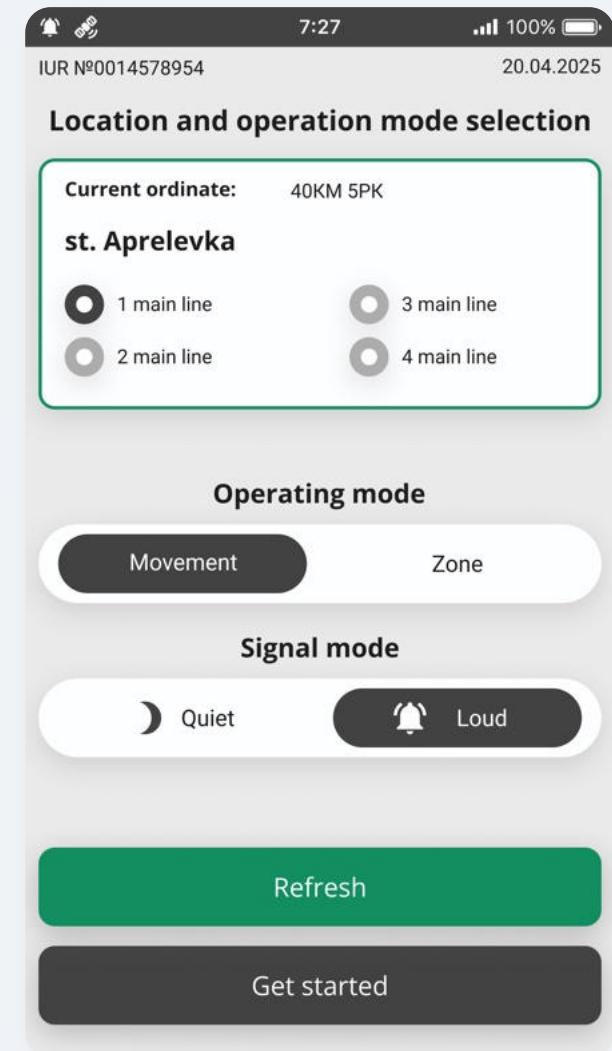


## Key functions

- Informing workers about the approach of rolling stock to the worksite
- Alerting operators about obstacles for rolling stock movement

## Additional functions

- Controlling the movement of workers during the passage of rolling stock
- Providing individual and collective alerts of workers about the approaching of rolling stock
- Recording the actual time of works execution



# SPAS APPLICATION



## Areas of application

- Running lines (single and multiple tracks)
- Stations



## Type of works

Without track closure  
(notification)



## Type of crews

- Track maintenance crews
- Diagnostic crews

# REQUIREMENTS FOR SPAS OPERATION

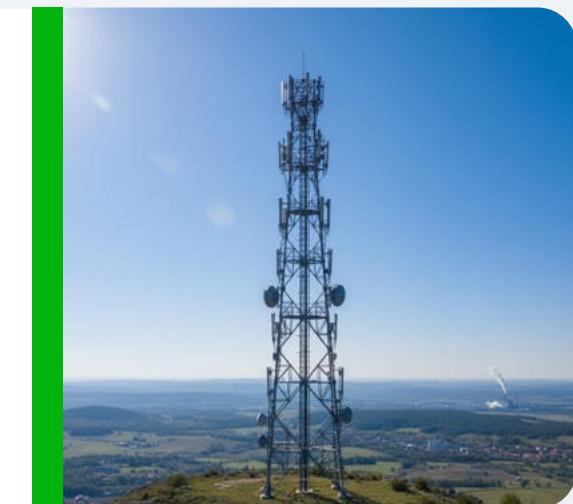
1

**Availability of technical diagnostics and monitoring systems** or other data sources (DC) capable of transmitting information to the SPAS server about the position of switches, the status of track circuits, and signals

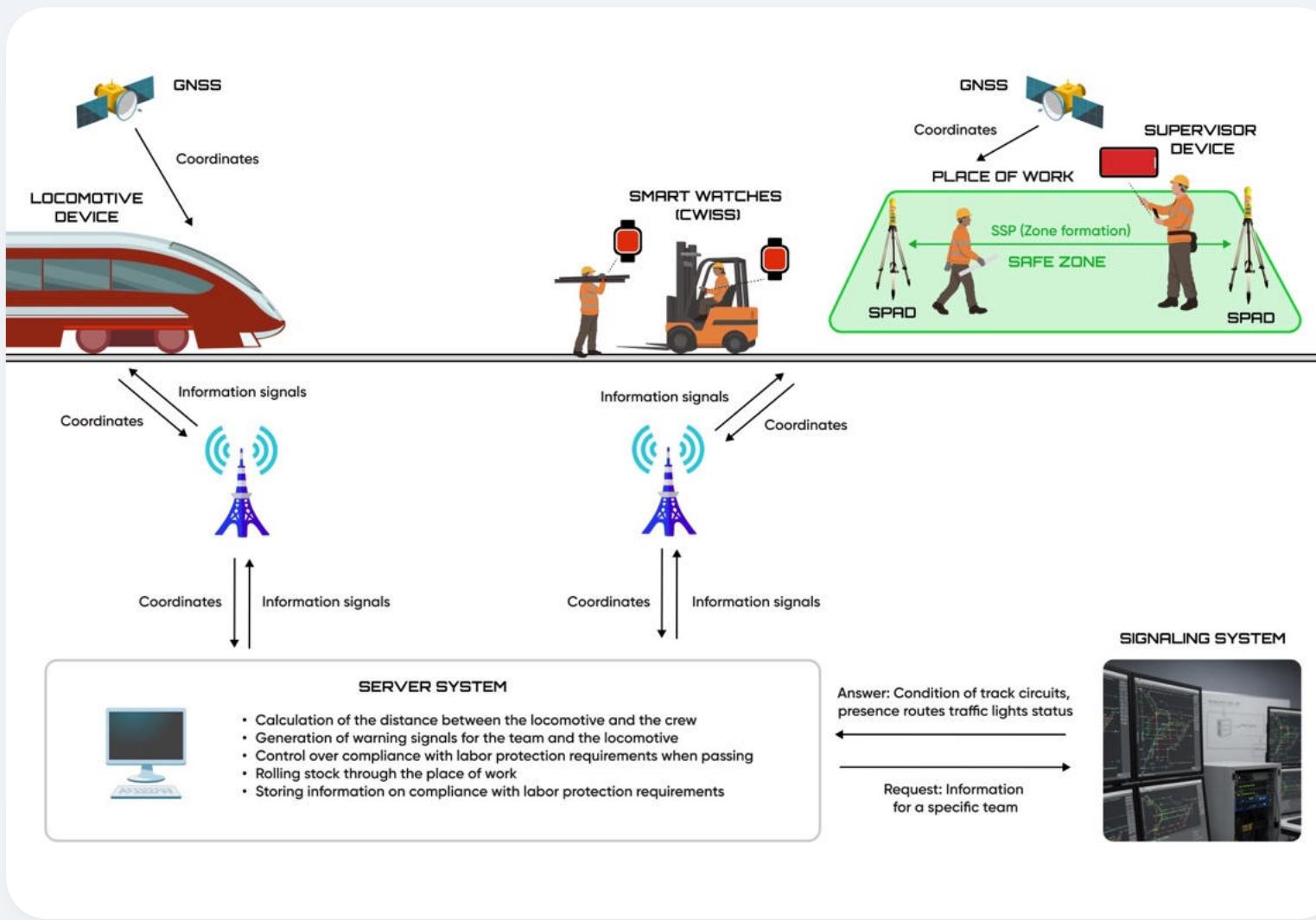


2

**Availability of reliable coverage** of GSM networks, 3rd generation and above



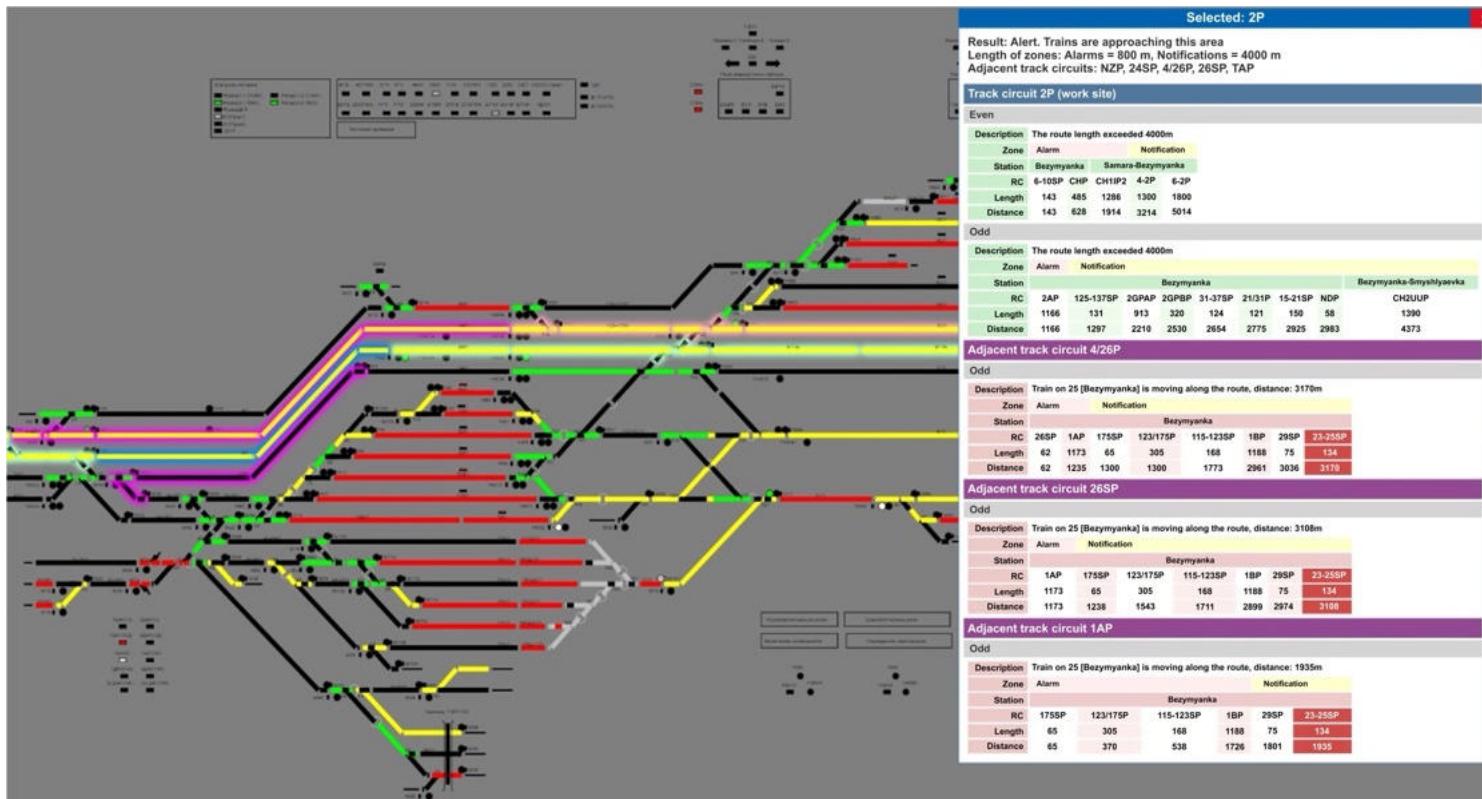
# DATA TRANSMISSION SCHEME



## SPAS provides

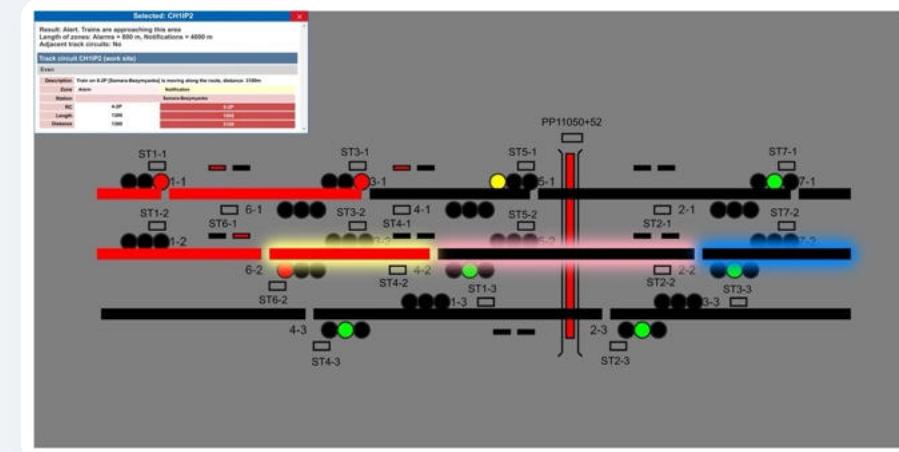
- Notification of the crew about the track number and the direction of the approaching rolling stock
- Target notification to locomotive crews about the approach to the worksite, including when moving to adjacent tracks
- Monitoring the approach of locomotives and other rolling stock not equipped with locomotive devices
- Using two independent sources of information about the approach of rolling stock (data from signaling system and data on the geographic coordinates of the locomotive module)

# SIGNAL FORMATION BASED ON SIGNALING DATA



## Implemented functionality

- Analysis of routes through the worksite
- Analysis of routes through adjacent tracks to the worksite
- Analysis of track circuit occupancy
- Calculation of distance to rolling stock based on the lengths of track circuits included in the routes



# EXAMPLE OF NOTIFICATION SIGNAL FORMATION

The figure illustrates the operation of SPAS with the integration of signaling system using a specific example

The worksite is designated as track 1BP →  
«Alarm» signal, as movement is occurring on an adjacent track →  
Distances for triggering «Alarm» and «Notification» signals →  
Adjacent track circuits for which notifications of movement will be issued →

Information about movement on each track is displayed separately →  
The direction of rolling stock movement has been determined →  
The length of the route is sufficient for timely notification →  
Track circuits are grouped into alarm and notification zones →  
Location of track circuits →  
Names of track circuits included in the alarm and notification zone →  
Length of track circuits included in the alarm and notification zone →  
Distance from the worksite to the rolling stock →

Information on movement on the adjacent track →

Selected: 1BP X

**Result: Alert. Trains are approaching this area**  
Length of zones: Alarms = 800 m, Notifications = 4000 m  
Adjacent track circuits: 5BP, 69SP, 33/69P, 31-37SP

## Track circuit 1BP (work site)

Odd

Description	The route length exceeded 4000m					
Zone	Alarm			Notification		
Station	Bezymyanka			Bezymyanka-Smyshlyaevka		
RC	29SP	23-25SP	NP	N1IP1	3P	5P
Length	75	134	153	1390	2040	1203
Distance	75	209	362	1752	3792	4995

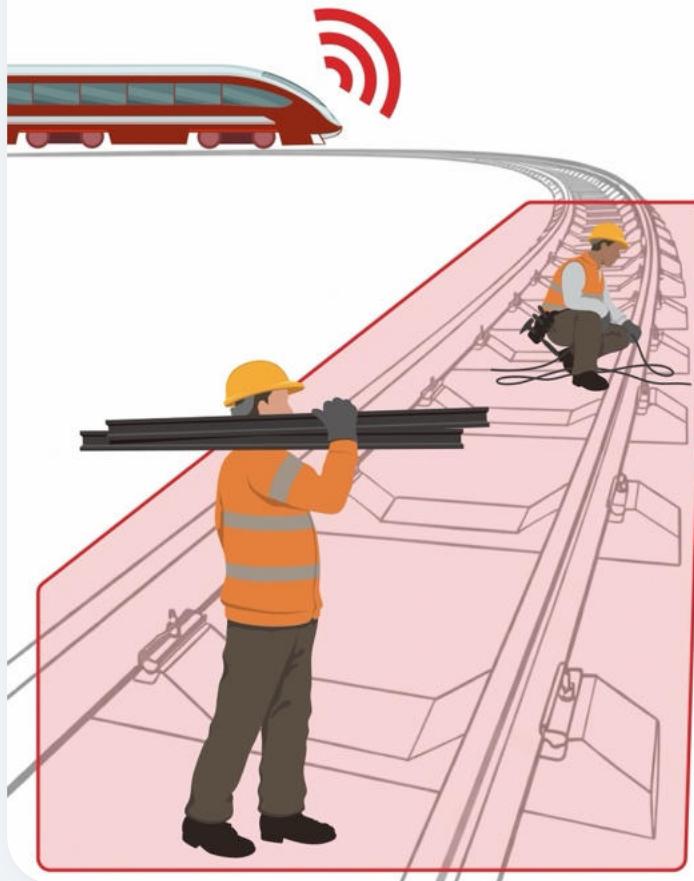
## Adjacent track circuit 1AP

Odd

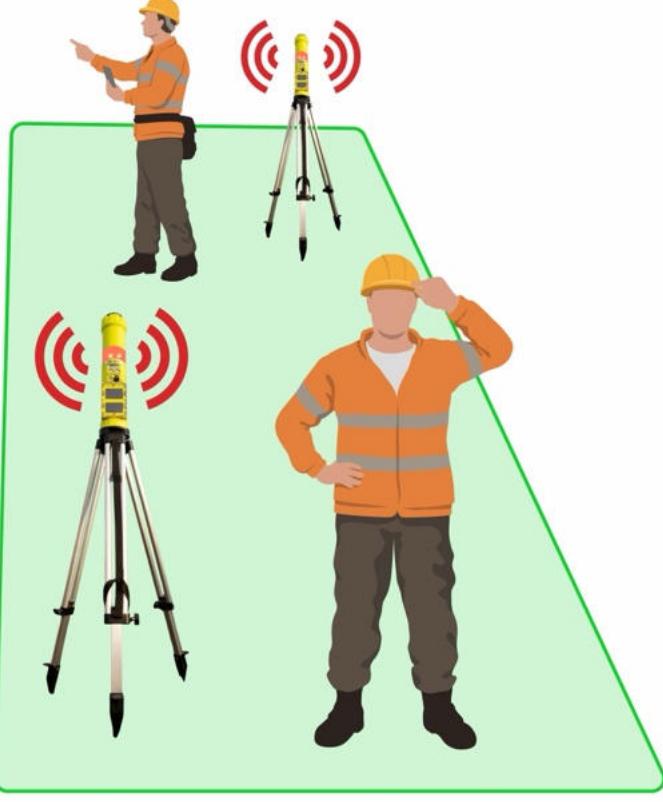
Description	The train is on this section	
Zone	Alarm	
Station	Bezymyanka	
RC	5BP	
Length	896	
Distance		

# SYSTEM APPLICATION BY MAINTENANCE CREWS

## DANGER



## SAFETY ZONE

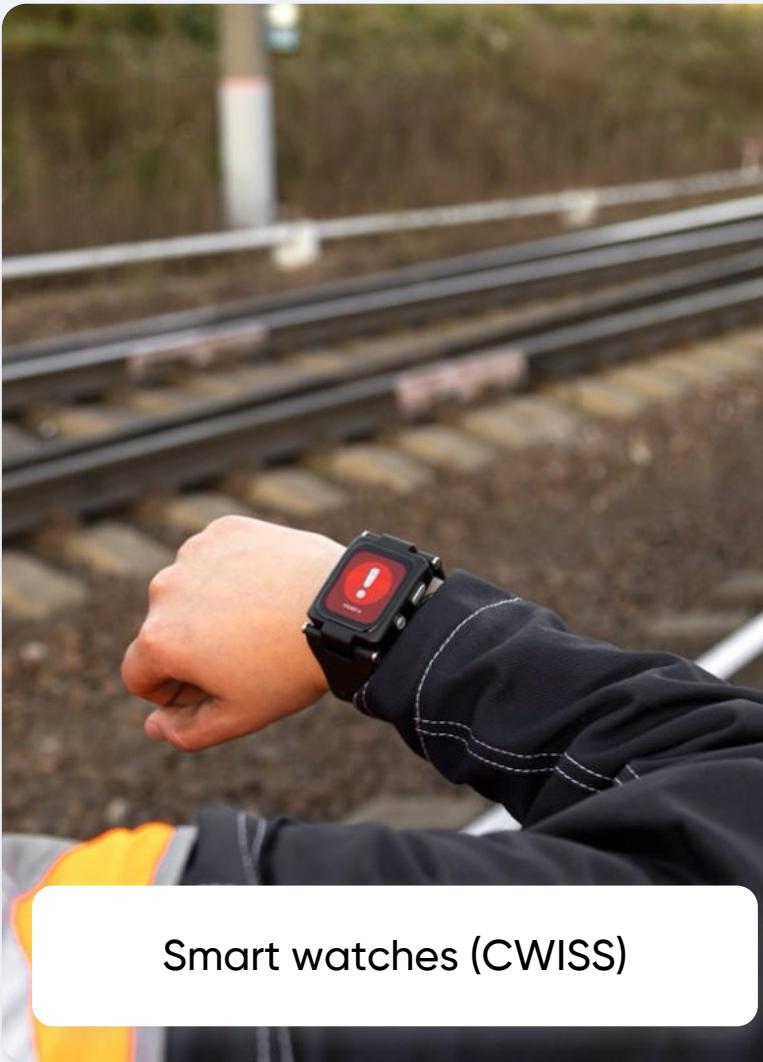


- The crew creates a **virtual safety zone** at the trackside using devices integrated into the System
- The System provides **timely notifications to the crew** about the approach of rolling stock
- The devices monitor the movement of workers **into the safety zone**
- If workers are in the danger zone, the System promptly informs the track maintenance crew and the locomotive crew about **the approaching rolling stock at a critical distance** from the worksite
- In case of an emergency, the supervisor can manually activate **the alarm signal** on the individual devices of each worker and on the locomotive device

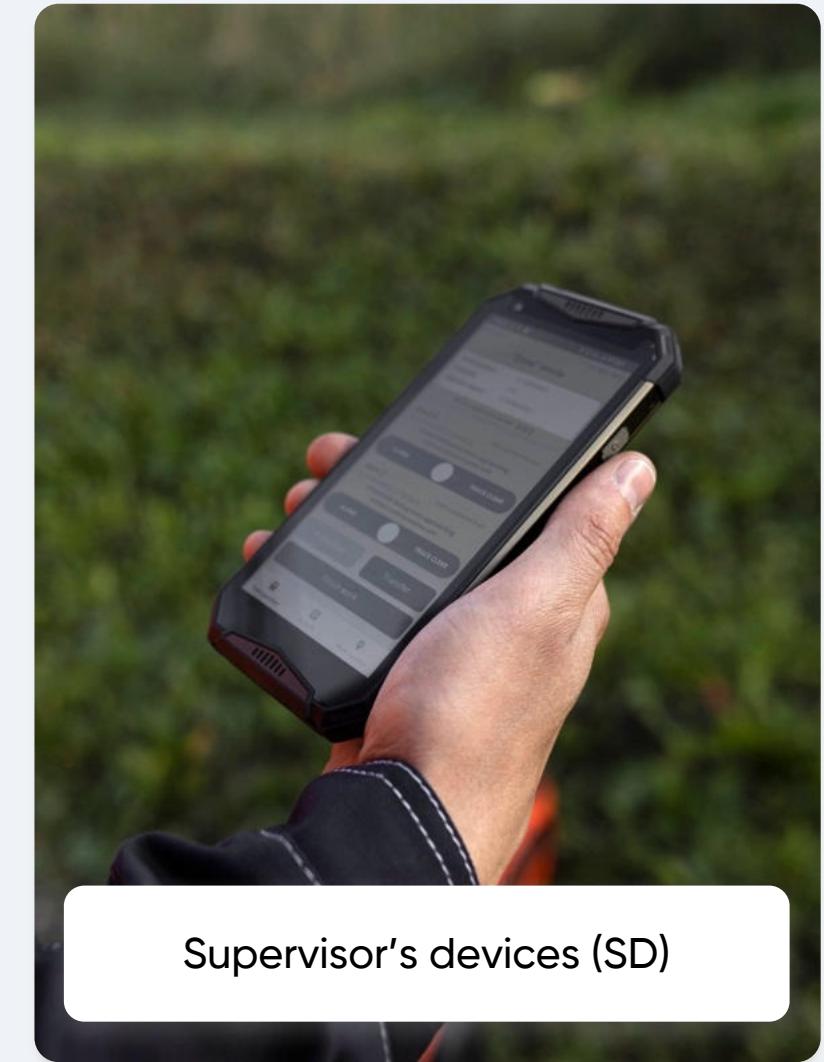
# SPAS DEVICES



Safety Perimeter and Alerting Device (SPAD)



Smart watches (CWISS)



Supervisor's devices (SD)

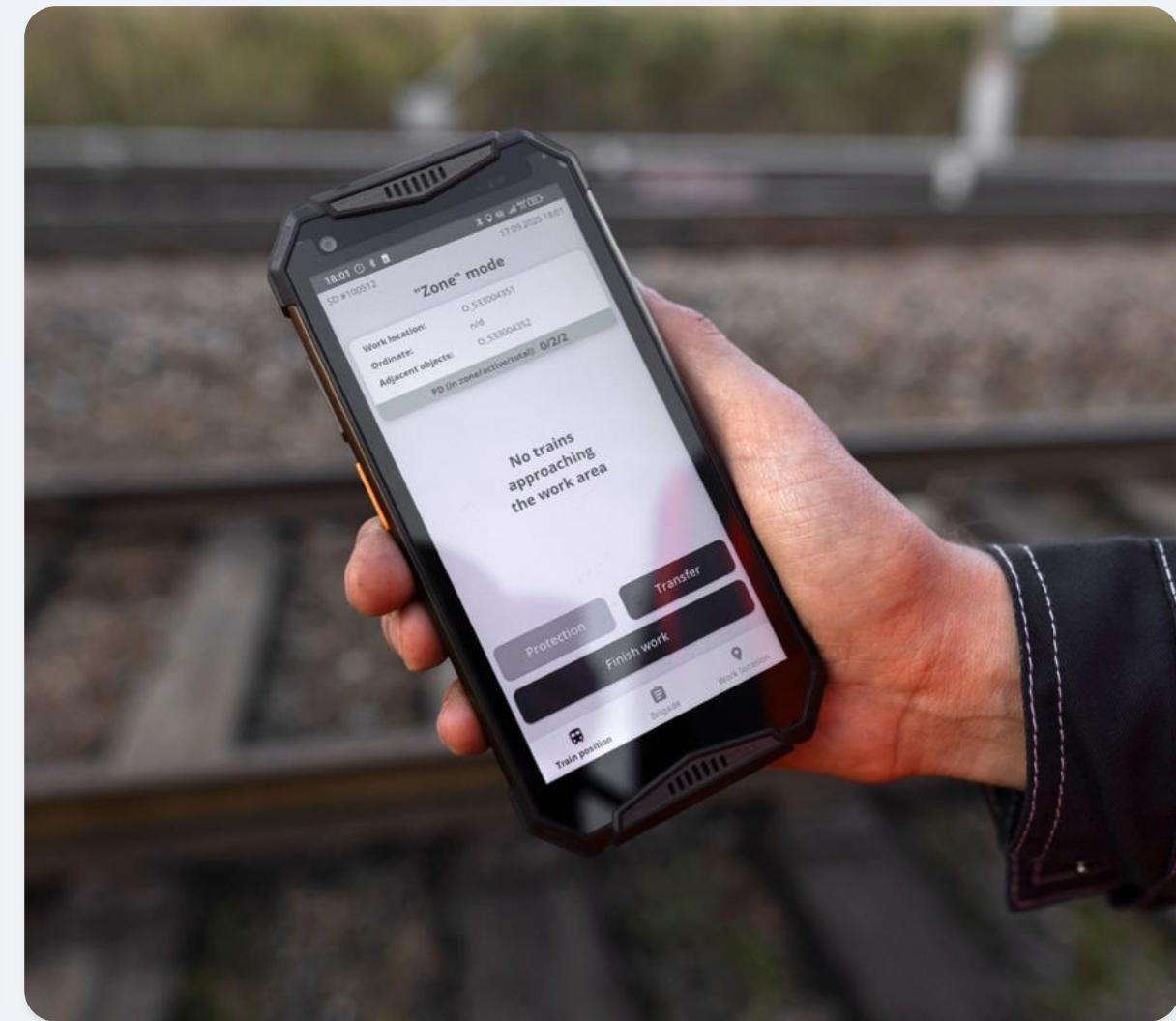
# SUPERVISOR'S DEVICES (SD)

## Technical Specifications

- Dust and Moisture Protection: IP68/IP69K standard
- Impact Resistance
- Battery Capacity: 10,850 mAh (over 12 hours at  $t = -45^{\circ}\text{C}$ )
- Support for required communication standards

## Functions

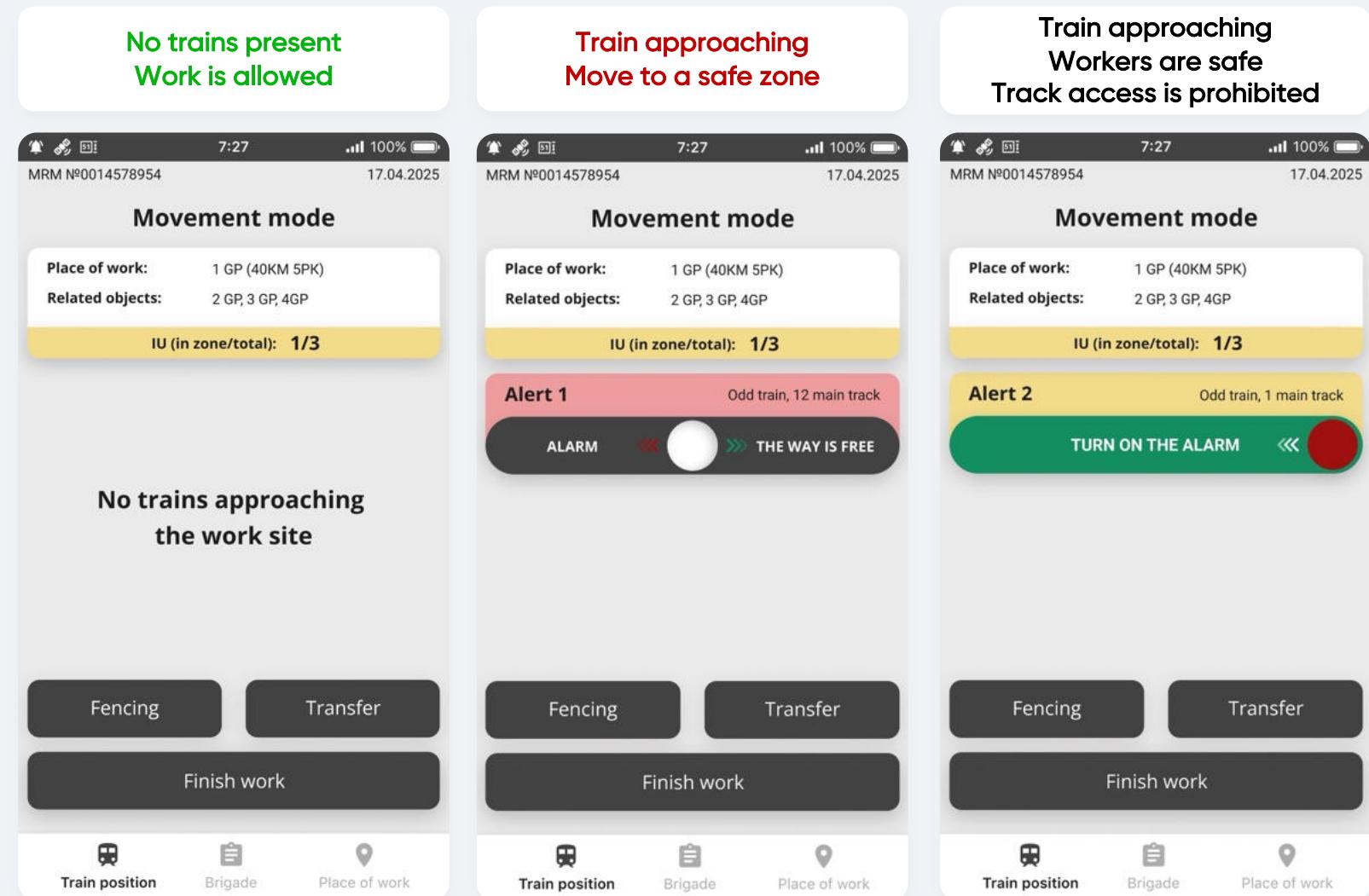
- Built-in self-diagnosis
- Crew management
- Selection of work location and mode
- Playback of light and sound alarms
- Monitoring the status of all crew devices
- Displaying information about approaching trains
- Issuing alarm or track occupancy signals to approaching trains
- Verifying compliance of the worksite with actual location



# FUNCTIONS OF THE SUPERVISOR'S DEVICES

## Displaying information about the approaching train

- Direction of movement (up and down traffic)
- Current location



## Functionality

- Playback of sound and vibration alarms
- Issuing alarm or track occupancy signals to the locomotive device

# ANCORS (SPAD) AND SMART WATCHES (CWISS)

## SPAD functions

- Playback of light and sound alarms (collective notification)
- Displaying Information about the approaching train
- Issuing alarm or track occupancy signals to approaching trains
- Establishing a safety zone and monitoring workers' location



## CWISS functions

- Sound signal
- Light signal
- Vibration signal



# DESKTOP APP FUNCTIONS



Tracking  
of devices



Real-time  
monitoring  
of maintenance  
crew operations



Real-time  
tracking  
of locomotive  
devices



Formation  
of reporting  
documentation

# DESKTOP APP FUNCTIONS

## Device tracking

- Tracking of devices throughout their lifecycle (operation, maintenance, storage, decommissioning)
- Storage of accompanying documents (handover certificates, defect reports)

**DEVICE TRACKING**

Search for a device by keywords...

Device ID: Enter device ID

Device type: Select device type

Road: Select the road

Department: Select department number

Production site: Select production site

Status: Select status

Date of acceptance: Select date of acceptance

Employee number of the person in charge: Select employee number

Device ID	Type	Status	Condition	Road	Department	Sector	Responsible person
010032	KUOBZ	Operation	Functioning	KBSH	PCH-11	2	11022872
010033	KUOBZ	Operation	Functioning	KBSH	PCH-11	1	11384303
010034	ИУР	Written off	Malfunctioning	KBSH	PCH-11	1	12323415
010035	ИУ	Operation	Functioning	KBSH	PCH-11	3	11232257
010036	KUOBZ	Operation	Functioning	KBSH	PCH-11	4	12323415
010036	KUOBZ	Storage	Functioning	KBSH	PCH-11	4	12323415
010036	KUOBZ	Operation	Functioning	KBSH	PCH-11	4	12323415
010036	KUOBZ	Repair	Malfunctioning	KBSH	PCH-11	4	12323415
010036	KUOBZ	Operation	Functioning	KBSH	PCH-11	4	12323415
010036	KUOBZ	Operation	Functioning	KBSH	PCH-11	4	12323415
<b>+ Add a new device</b>							

# DESKTOP APP FUNCTIONS

## Monitoring the operations of maintenance crews

The system allows real-time monitoring of the following parameters:

- Approach of rolling stock and its direction
- Distance to the rolling stock
- Signaling on devices
- Actions of supervisor and crew members (button presses or workers movement to the safe zone)

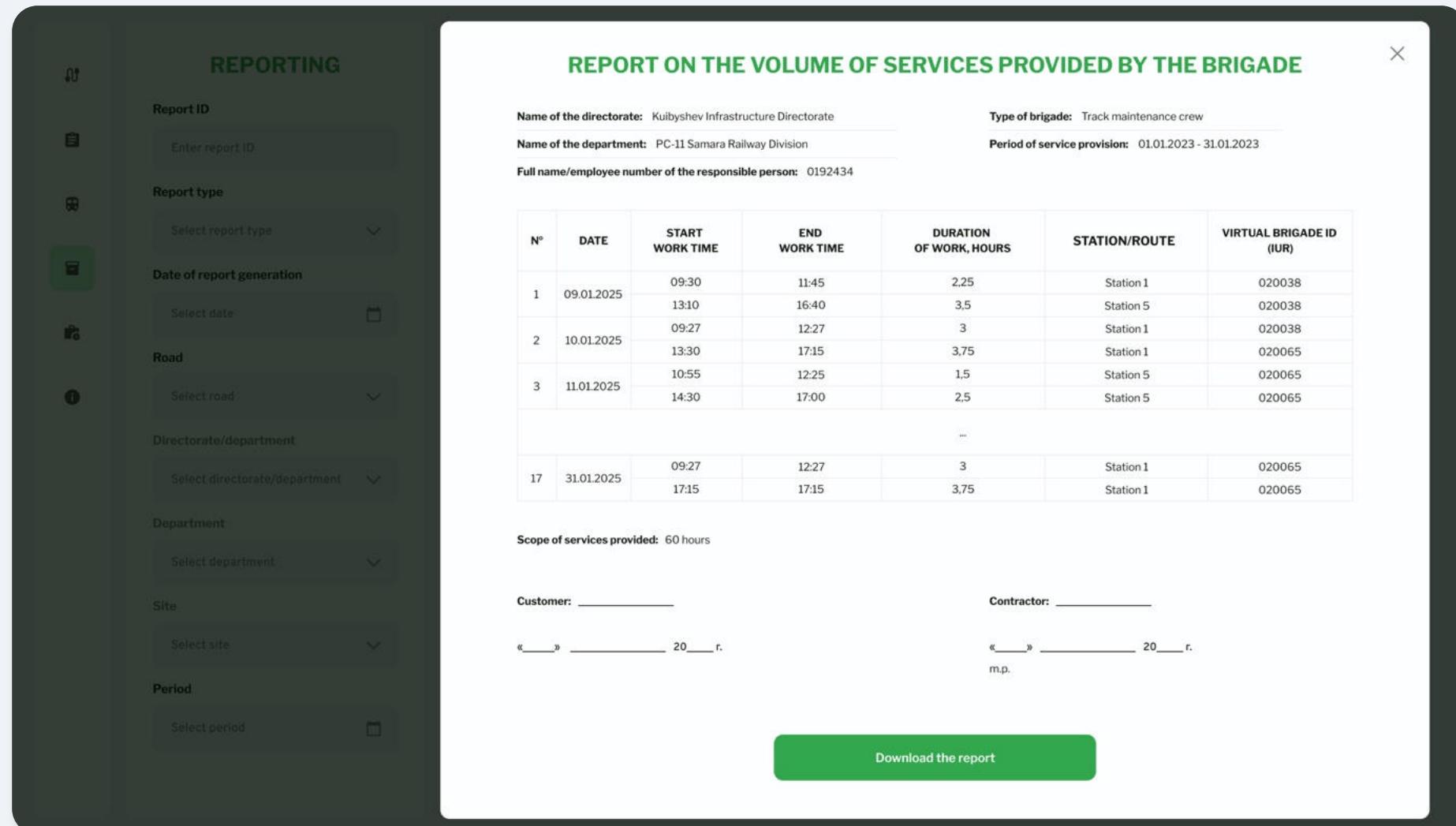
The image shows two screenshots of a desktop application interface. The left screenshot is titled 'BRIGADE MANAGEMENT' and includes fields for 'IUR ID' (with a placeholder 'Enter IUR ID'), 'Device' (placeholder 'Enter device ID or type'), 'Employee number of the person in charge' (placeholder 'Select employee number'), 'Road' (placeholder 'Select road'), 'Department' (placeholder 'Select department number'), 'Station/route' (placeholder 'Select station/route'), and 'Start/end date' (placeholder 'Select start/end date'). The right screenshot is titled 'BRIGADE No. 010032' and shows a summary card with '5 In zone/active/total' and 'IU 1/2/2'. It includes sections for 'Operating mode' (Off, Zone, Fencing), 'Signal mode' (Quiet, Loud, Relocation), and 'Brigade membership', 'Place of work', and 'Signals' tables. The 'Place of work' table shows a row for 'KBSH' at 'Station 1' with coordinates '1121km4pk+10 - 1121km4pk+50'. The 'Signals' table shows two rows: one for 'Nº 1' with 'UIPPS 03552004', 'Direction Even', 'Track Adjacent', 'Distance to PS APK-DK: 1800, SADR: 1930', 'Rail chains Alert: IPP, 3PP, Alarm: NAP, ISP', and 'UIPPS: Alert 1, KUOBZ: Alert 1'; and another for 'Nº 2' with 'UIPPS -', 'Direction Odd', 'Track Adjacent', 'Distance to PS 380 (APK-DK), 1340 (SADR)', 'Rail chains -', and 'Signal Alert 2 (KUOBZ)'. A map at the bottom shows a red dot indicating the location of the brigade.

# DESKTOP APP FUNCTIONS

## Formation of reporting documentation

The system enables automated generation of reporting documentation, which serves as the basis for mutual settlements for the services provided

Log files for the operations of each crew are also available for export



The screenshot displays the desktop application's reporting interface and a generated report. The reporting interface on the left includes fields for Report ID, Report type (with a dropdown menu), Date of report generation (with a date picker), Road (with a dropdown menu), Directorate/department (with a dropdown menu), Department (with a dropdown menu), Site (with a dropdown menu), and Period (with a date range picker). The generated report on the right is titled 'REPORT ON THE VOLUME OF SERVICES PROVIDED BY THE BRIGADE'. It shows the following details:

**Header:**

- Name of the directorate: Kuibyshev Infrastructure Directorate
- Type of brigade: Track maintenance crew
- Name of the department: PC-11 Samara Railway Division
- Period of service provision: 01.01.2023 - 31.01.2023
- Full name/employee number of the responsible person: 0192434

**Table:**

Nº	DATE	START WORK TIME	END WORK TIME	DURATION OF WORK, HOURS	STATION/ROUTE	VIRTUAL BRIGADE ID (IUR)
1	09.01.2025	09:30	11:45	2,25	Station 1	020038
		13:10	16:40	3,5	Station 5	020038
2	10.01.2025	09:27	12:27	3	Station 1	020038
		13:30	17:15	3,75	Station 1	020065
3	11.01.2025	10:55	12:25	1,5	Station 5	020065
		14:30	17:00	2,5	Station 5	020065
				...		
17	31.01.2025	09:27	12:27	3	Station 1	020065
		17:15	17:15	3,75	Station 1	020065

**Text:**

- Scope of services provided: 60 hours
- Customer: \_\_\_\_\_
- Contractor: \_\_\_\_\_
- «\_\_\_\_» \_\_\_\_ 20 \_\_\_\_ r.
- «\_\_\_\_» \_\_\_\_ 20 \_\_\_\_ r.
- m.p.

**Buttons:**

- Download the report

# SPAS EXTENDED FEATURES

SPAS can be integrated with the enterprise systems such as ERP, WFM, etc.

This solution will enable objective monitoring of work execution through SPAS devices in the following areas:



**Compliance  
of the crew  
size with the  
planned work**



**Adherence  
to safety  
regulations**



**Monitoring  
compliance  
of the worksite  
location**



**Tracking  
work time**

# CTRL+ IS A RELIABLE PARTNER ON THE WAY TO MODERN AND SAFE OPERATIONS OF RAIL TRANSPORT

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