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REPORT

on research, analysis, traffic safety measures developed to avoid life-threatening situation on the road and pedestrian safety system

Stage 3: Develop a pedestrian safety system applicable to each of the target road sections

РУМЪНИЯ - БЪЛГАРИЯ

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Project title: Better connected secondary and tertiary nodes to TEN-T core and comprehensive network through joint CBC measures/Project cod: ROBG-383

The project is co-financed by the European Union through European Regional Development Fund under the Interreg V-A Romania-Bulgaria Programme

This report has been developed within the framework of the project "Better connected secondary and tertiary nodes to TEN-T core and comprehensive network through joint CBC measures", Project code: ROBG - 383, financed under the CBC Programme "INTERREG V-A Romania - Bulgaria" 2014-2020, co-financed by the European Union through the European Regional Development Fund. The project partners are Veliko Tarnovo Municipality, Bulgaria, Calafat Municipality, Romania and Future Today Association, Bulgaria. The main objective of the project is to improve the conductivity of the Pan-European Transport Corridors (PTC) No 4, No 7 and No 9 in the cross-border region of Bulgaria and Romania, by rehabilitating and upgrading 6,614 km of road infrastructure with proven cross-border impact and direct connection to the core infrastructure of the Trans-European Transport Network (TEN-T) and developing 3 joint mechanisms (traffic safety measures, route guidance and safety awareness campaign) to facilitate the connection of the secondary transport corridors.

A report on the survey, analysis, traffic safety measures developed to avoid life-threatening situation on the road and pedestrian safety system in 3 phases has been created within the project activity "Implementation of traffic safety measures", with the main objective to include and implement at least one method and its applicable developed traffic safety measures to avoid life-threatening situation and pedestrian safety system on each of the following road sections:

- Str. Opalchenskaya, city of Veliko Tarnovo - from the connection with the road III-514 to the connection with the road E-85 (I-5) str. Theodosii Tarnovski from the road connection from str. "Magistralna" (ROAD E772 (I-4)) to str. Dimitar Naydenov str. Dimitar Naydenov str. from Dimitar Naydenov str. "Theodosius Tarnovsky" to str. "Slivnitsa", str. "Slivnitsa" from str. Dimitar Naydenov to Slivnitskaya str. Kliment Ohridski, str. Kliment Ohridski from str. Slivnitsa to a new bridgehead on the Yantra River and str. Ksiliforska from a new bridgehead on the Yantra River to road III-514
- Part of road E79 within the territory of Ruzhintsi Municipality - intersection of road III-114 with E-79;
- the exit from the port of Calafat to E-79, which is ul. Jui Blvd. Horia, Cloșca și Crișan, town of Cloșca. Calafat.

By implementing the developed road safety measures to avoid life-threatening situations on the road, the aim is to contribute to the implementation of the EU-wide policy to reduce road accident casualties, to conduct preventive education campaigns and to achieve one of the strategic objectives of the European Union

White Paper on Transport: 'No road accident deaths by 2050'. This report will be shared with the local authorities and the project partners (Veliko Tarnovo Municipality /Bulgaria/, Calafat Municipality /Romania/ and Ruzhinzi Municipality /Bulgaria/), with a proposal to include and implement at least one method and its applicable identified traffic safety measures to avoid life-threatening situation on the road for each targeted road section.

A three-part report has been developed to implement the activity:

- Stage 1: Results of a survey on the traffic situation and road traffic injuries for the targeted road sections. Good practices in traffic safety.
- Stage 2: Develop traffic safety measures to avoid life-threatening situation on the road
- Stage 3: Develop a pedestrian safety system applicable to each of the targeted road sections

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Pedestrians are the most vulnerable road users. To take effective measures to protect pedestrians, it is important to understand the causes, ramifications and possible sustainable strategies to prevent pedestrian deaths and injuries. Pedestrians are at high risk of injury primarily due to lack of pedestrian crossing facilities and indiscipline among road users.

Investigation of road accidents involving pedestrians and analysis of causes

Analysing the root causes of road accidents involving pedestrians helps to identify problem areas and put in place appropriate measures to reduce the risk of these accidents. It is important to note that the causes of accidents can vary depending on location, road infrastructure, road user behaviour and other factors. However, the main causes of accidents involving pedestrians are:

Improper crossing: Many pedestrian accidents are caused by pedestrians crossing the road improperly, without obeying the rules and signals at traffic lights or crosswalks where they are present.

Drivers speeding: Drivers speeding can lead to reduced reaction times and pedestrians crossing the road.

Pedestrian inattention: Some pedestrians may not be paying enough attention while crossing the road or crossing with cell phones and other distracting devices.

Inappropriate use of mobile devices by drivers: Drivers who use mobile devices while driving are less attentive to pedestrians and can create dangerous situations.

Insufficient visibility: poor weather conditions, low lighting or road infrastructure can reduce visibility for pedestrians and make visibility difficult for drivers.

Use of drugs or alcohol by road users: Alcohol or drug use by pedestrians or drivers can negatively affect their reactions and ability to move safely.

Failure of road users to obey the rules: Failure of pedestrians and drivers to obey the rules of the road is a common cause of accidents.

Children's lack of understanding of the road environment: Children, especially younger ones, may have difficulty appreciating the risks and rules when crossing the road.

Infrastructure problems: some sections of roads may be poorly designed or equipped, making it difficult for pedestrians to cross safely.

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Lack of road safety knowledge and training can lead to carelessness and misbehaviour on the street.

To reduce road accidents involving pedestrians, it is important to take measures such as awareness campaigns on road safety, improving road infrastructure, increasing pedestrian visibility, enforcing traffic rules and creating safer pedestrian areas. These measures should be implemented jointly by municipalities, transport agencies, educational institutions and other stakeholders to achieve greater pedestrian safety on the roads.

There is no accessible database on road accidents involving pedestrians, specifically for the targeted road sections. Available statistics are areas, making it difficult to plan and inform management decisions.

Measures to tackle the main causes of road accidents involving pedestrians in road sections

Below are some of the most sustainable strategies and approaches to improve pedestrian safety. The role of police and other law enforcement agencies is vital to their implementation. Strict enforcement of traffic laws and pedestrian discipline are critical to achieving pedestrian safety.

1) Reducing pedestrian exposure to vehicular traffic: there are a number of specific engineering measures to ensure this. Most of these measures involve separating pedestrians from vehicles or reducing traffic volumes: constructing usable sidewalks/ crosswalks; installing marked crosswalks. The purpose of a marked crosswalk is to indicate the optimal or preferred crossing location for pedestrians. Marked crossings help indicate the pedestrian priority and drivers should yield to pedestrians at these points; construct pedestrian overpasses and underpasses; design mass transit routes - pedestrian safety is a key issue to consider in the design of any mass transit system, including routes and stops. Mass transit routes are typically located along major arterials, which are the most dangerous types of urban streets. Although traveling by public transit may be one of the safest modes, transit riders are at high risk of crashes when walking to and from the station or stop.

2) Reduce vehicle speed: One of the most effective ways to improve pedestrian safety is to reduce vehicle speed. If possible, speed management measures should be used in conjunction with measures to reduce pedestrian exposure to vehicular traffic. Speed management is much more than setting and enforcing appropriate

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speed limits. It uses a range of engineering, enforcement and education measures to balance safety and effective vehicle speed on the road network.

3) Improve Pedestrian Visibility: A high percentage of pedestrian collisions and fatalities are due to low-light conditions. There are a number of engineering and behavioural measures that make pedestrians more visible to drivers, especially at dusk, dawn and night.

4) Improving pedestrian and motorist safety awareness and behaviour: Changing driver and pedestrian attitudes is a complex long-term endeavour that requires the implementation of various interventions such as: education, outreach and training - safe road user behaviour and reduced pedestrian fatalities depend not only on knowledge and skills but also on community support, perceptions of vulnerability and risk, social norms and patterns, engineering measures and enforcement; media Targeted and planned mass media and social marketing campaigns informing the public about pedestrian safety laws and risk factors are needed to improve driver and pedestrian behavior and improve understanding of traffic issues, such as road signs and priority for all road users.

5) Traffic law enforcement: traffic laws affecting pedestrian safety are largely aimed at controlling pedestrian and driver behaviour at intersections, crossings and other locations. Comprehensive legislation is a key element of pedestrian safety, but legislation alone is unlikely to facilitate behaviour change in the absence of enforcement and adequate penalties.

6) Improving vehicle design to protect pedestrians: Motor vehicles are becoming safer for passengers due to improvements in vehicle design. Until recently, vehicle design included few features to protect pedestrians, but there are increasing efforts to incorporate design features that reduce the likelihood of pedestrian collisions and/or reduce the severity of pedestrian injury in the event that a crash occurs between a vehicle and a pedestrian.

7) Provide care for injured pedestrians: the primary goal of pedestrian safety should be to prevent traffic crashes in the first place. However, pedestrians do get hurt, despite efforts and intentions. An effective post-crash response can minimize the consequences of serious injury, including long-term morbidity or mortality. Pedestrians struck by high-energy-transfer vehicles end up with high residual mobility impairment and also have significantly higher mortality rates than vehicle occupants.

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Specific measures and methods applicable to the targeted road sections

A pedestrian safety system is a comprehensive approach used to protect and prevent the risks associated with pedestrian movement on streets and roads. This system includes various measures and technologies that aim to ensure safe movement and reduce the risk of road accidents for people crossing the roads. Specific measures needed to ensure pedestrian safety on targeted roadway segments are:

➢ Construction of footpaths and pedestrian zones

There is a need for dedicated pedestrian crossings and areas providing safe pedestrian crossing and separating pedestrians from vehicular traffic. Sidewalks on both sides of the targeted road segments should be completed and upgraded where they are in a compromised condition or completely missing. Pedestrian crosswalks and pedestrian areas are essential on targeted roadway segments where pedestrian traffic is heavy. They provide safe and secure routes for pedestrians, separating them from vehicles and providing a range of benefits for all road users. The benefits and improvements that footways and pedestrian zones provide include:

- ✓ Enhancing pedestrian safety
- ✓ Improving mobility
- ✓ Stimulating active transport
- ✓ Improving the urban environment
- ✓ Environmental benefits
- ✓ Improving public health

➢ Installation of pedestrian traffic lights and pedestrian lights

Traffic lights and pedestrian lights are extremely important in areas of high pedestrian activity and at intersections where there are many crossings of traffic flow. These devices provide regulation and organisation of pedestrian traffic, giving signals when it is safe to cross the road and when they should refrain from crossing. The benefits and improvements that traffic signals and pedestrian lights provide include:

- ✓ Greater safety
- ✓ Greater traffic control and organisation
- ✓ Better visibility and awareness
- ✓ Encouraging active transport

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- ✓ Ease of pedestrian crossing

➢ **Construction of pedestrian underpasses and overpasses**

Pedestrian underpasses and overpasses are important infrastructure elements that provide a safe and convenient way for pedestrians to cross roads. These structures allow pedestrians to move from one side of the road to the other without having to cross the traffic flow directly. The construction of overpasses is feasible for any of the roadway segments, and it is the responsibility of local governing bodies to identify possible locations for their construction. As a rule of thumb, they shall be built on busy road sections, near educational establishments, in urban areas, near public buildings and transport interchanges, on road sections with limited visibility. The advantages and improvements that pedestrian underpasses and overpasses provide include:

- ✓ Enhancing pedestrian safety
- ✓ Improving mobility
- ✓ Reducing congestion
- ✓ Improving the urban environment
- ✓ Support sustainable transport
- ✓ Improving public health

➢ **Organizing and conducting educational campaigns**

The organisation and implementation of educational campaigns related to pedestrian safety is essential to improve pedestrian behaviour on the road and to reduce the number of road accidents involving pedestrians. When designing a programme for their implementation, it is necessary to focus on the following aspects:

- ✓ Raising awareness: Education campaigns should inform pedestrians about important road safety rules and principles. Better awareness increases the likelihood that pedestrians will adhere to the correct behaviour when crossing the street or using crosswalks.
- ✓ Improving skills: Education campaigns should provide practical tips and exercises that help pedestrians develop better skills and techniques for crossing the street safely and interacting with other road users.
- ✓ Understanding the risks: Campaigns should help pedestrians to better understand the risks associated with their actions on the road. By being aware of these risks, pedestrians are more likely to be attentive and responsible while on the move.

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- ✓ Apply good practice: education campaigns should encourage the application of good road safety practices, leading to improved behaviour and lower risk of road accidents.
- ✓ Changing safety culture: Campaigns should help to change the safety culture among pedestrians. By encouraging responsible behaviour and respect for the rules, pedestrians become more aware and their behaviour improves.
- ✓ Improving road safety: When pedestrians obey the rules and behave responsibly on the road, the risks of traffic accidents are significantly reduced. This leads to greater safety for pedestrians, but also for other road users such as drivers and cyclists.

Education campaigns are a powerful tool to improve pedestrian safety and reduce the risks of road accidents involving pedestrians directly or indirectly. They provide knowledge, skills and information that are essential for pedestrian behaviour and safety on the road.

➢ Speed limits

The introduction of speed limits related to pedestrian safety is essential to protect their lives and reduce the risk of serious traffic accidents. Pedestrians are particularly vulnerable road users and are more at risk in collisions with vehicles travelling at higher speeds. The main reasons for the need to introduce speed limit measures include protecting pedestrian life and health, reducing the risk of accidents, improving visibility and reaction times, calming traffic on road sections, improving the overall safety of the street environment.

Specific measures to implement speed limits for pedestrian safety include:

- ✓ Posting of road signs: Designating areas with speed limits and warning signs for entering pedestrian areas where lower speed limits must be observed.
- ✓ Placing special pedestrian zones: Designating pedestrian areas with special markings on the road surface that tell drivers to slow down.
- ✓ Using speed cameras: Installing speed cameras can help control the speed of vehicles and punish drivers who exceed speed limits.
- ✓ Education campaigns: Running education campaigns that inform drivers about the importance of obeying speed limits and the consequences of exceeding them can have a positive effect on their behaviour on the road.
- ✓ Police patrols: Enhanced enforcement and the presence of police patrols in pedestrian areas can assist drivers' compliance with speed limits.

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- ✓ Architectural and Design Solutions: Building street infrastructure that encourages slower speeds can help create safe conditions for pedestrians - crosswalks, street humps, street islands.

➢ Technologies to improve safety

The introduction of pedestrian safety technologies in targeted road sections plays a key role in improving pedestrian safety by providing various innovative solutions to reduce the risk of road accidents. Here are several types of technologies applicable for deployment in the sections:

- ✓ Pedestrian cameras and sensors: these cameras and sensors monitor pedestrian movement and identify pedestrian violations. They help control traffic and alert drivers to the presence of pedestrians in the vicinity.
- ✓ Installation of smart message boards: These boards are used to provide road safety information and warnings to drivers about dangerous areas or pedestrian zones.
- ✓ Develop a pedestrian safety mobile app: A mobile app should be developed for each roadway to provide information on safe pedestrian routes, warnings about hazardous areas, and tips for safe street behavior.
- ✓ Virtual and augmented reality: These technologies are used to train and simulate different pedestrian safety scenarios on specific road sections, providing a realistic experience and raising awareness.
- ✓ Smart lights and lighting: The use of smart lights and lighting on the road improves pedestrian visibility and reduces the risk of accidents due to reduced visibility.

These technologies have great potential to improve pedestrian safety and reduce the number of pedestrian-involved road accidents. However, technologies should be complementary to other road safety measures and solutions.

➢ Installation of road signs and markings

Road signs and markings play an important role in improving pedestrian safety by providing clear instructions and warnings to drivers and pedestrians. They help improve traffic organisation and traffic management, which reduces the risk of road accidents involving pedestrians. Road signs and markings should be placed at strategic locations on road sections where there is a concentration of pedestrians, including at key junctions. The purpose of signs and markings should be to:

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- ✓ Clear guidance on behaviour: road signs provide clear guidance to drivers and pedestrians on the correct behaviour on the road. This includes crosswalk signs, stopping cars for pedestrians, speed limits in pedestrian areas and more.
- ✓ Hazard Warnings: Signage and warning signs should inform of hazardous areas or sections of the street where special attention is needed because of pedestrian traffic.
- ✓ Lane Separation: Markings are essential to clearly separate lanes and identify pedestrian spaces. They prevent pedestrians from possibly misunderstanding the lanes or crossing the road dangerously.
- ✓ Improving visibility: Special markings and reflective signs increase pedestrian visibility, especially at night or in bad weather. This helps drivers to spot pedestrians in time and take appropriate measures to cross the street safely.
- ✓ Awareness raising: the posting of road signs and pedestrian safety markings provides information to road users that helps raise their awareness of correct behaviour and precautions.
- ✓ Conflict reduction: Proper placement of traffic signs and markings can reduce conflicts between vehicles and pedestrians and help create a safer street environment.

Types of traffic signs and markings to improve pedestrian safety that may be placed at targeted roadway segments include:

- ✓ Pedestrian traffic lights and zebras (pedestrian crossings)
- ✓ Pedestrian warning signs (e.g., "School", "Pedestrian", "Pedestrian Crossing Hazard" signs, etc.)
- ✓ Speed limits in pedestrian areas
- ✓ Striping to mark pedestrian crossings and areas
- ✓ Pedestrian crosswalk lighting and markings for night visibility

The benefits of road signs and markings are numerous and include:

- ✓ Reducing the risk of pedestrian accidents
- ✓ Increasing driver and pedestrian awareness and education
- ✓ Improvement of traffic organisation and traffic flow
- ✓ Provide a safer and more comfortable environment for pedestrians to actively move and cross the street
- ✓ Reducing potential conflict between different road users

The benefits and advantages of introducing the pedestrian safety system in the targeted road sections

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- Reducing the risk of accidents: the system helps prevent road accidents and reduces the risk of pedestrian-related accidents.
- Improving road safety: Pedestrian measures and infrastructure help improve road safety and provide better conditions for pedestrians.
- Encourage active transport: The system encourages the use of active transport (walking and cycling), which is an environmentally acceptable choice and improves people's health.
- Better traffic organisation: The system helps to better organise traffic and optimise traffic flows.
- Improved public health: Improved pedestrian safety contributes to a reduction in the number of people injured and killed on the roads, which has a positive effect on public health.
- Increased sense of safety: The system provides pedestrians with a greater sense of safety and confidence when moving on the streets.
- Reducing congestion: Better traffic management and pedestrian crossing points help to reduce congestion and improve traffic flow.

For the implementation of a pedestrian safety system, it is important that municipalities and transport agencies work together with experts and specialists to combine the appropriate measures and technologies depending on the specific needs and characteristics of the road section concerned, taking into account the current traffic situation. This process should include accident and risk assessment, pedestrian and driver education, traffic regulation and infrastructure changes to improve pedestrian safety. The table below identifies specific actions needed to improve the strategic planning process.

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Activity	Safe systematic approach							
	Improved mobility options	Enforcement, laws and regulations	Design and technology of vehicles	Street design and engineering	Land use planning	Speed control	Education and capacity building	Data and evaluation
Identify, develop and promote best speed management practices being implemented by states and localities to reduce speed-related fatalities and cover topics such as setting appropriate speed limits for all road users and countermeasures that slow traffic.	✓	X	X	✓	X	✓	X	X
Develop and implement a Pedestrian and Bicycle Care Initiative, to include outreach and marketing materials that educate stakeholders and consumers on safety tips for caring for passersby.	X	X	X	✓	X	✓	X	X
Organize a Pedestrian Safety Month with media and marketing materials promoting pedestrian safety and how state and local efforts support the effort.	X	✓	X	X	X	✓	✓	X
Establish a local Speed Management Plan	X	X	X	X	X	✓	X	X
Develop a pedestrian count model that can predict pedestrian counts at locations to inform planning and design	X	X	✓	✓	X	✓	X	✓

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Encourage innovation in pedestrian and bicycle safety that focuses on bicycle and pedestrian network planning, safety, and design issues, addressing short-term research needs of interest to the community.	✓	X	X	✓	X	✓	X	X
Organize and conduct classroom pedestrian safety courses and virtual offerings that address topics such as Developing a Pedestrian Safety Action Plan, Designing for Pedestrian Safety, and Modern Roundabouts: intersections designed for safety.	X	X	X	✓	X	X	✓	X
Create a Pedestrian and Bicycle Crash Analysis Tool, a crash data entry software that improves walking and bicycling safety by developing and analyzing a database containing motor vehicle and pedestrian/bicyclist crash details.	X	X	X	X	X	X	X	✓
Conduct training to increase municipal capacity to conduct a systematic traffic safety analysis to include a pedestrian module that focuses on risk factors	X	X	X	✓	X	X	✓	X
Holding annual meetings to share experiences with experts from neighbouring regions on measures and identified problems concerning pedestrian safety on urban roadways.	✓	X	X	✓	X	X	✓	X
Create a guide for effective selection of crosswalk patterns to more effectively prioritize future crosswalk placement at high visibility points for greater efficiency.	X	X	X	✓	X	X	✓	X
Develop a pedestrian safety partnership plan with stakeholder involvement that is	✓	✓	✓	✓	✓	✓	✓	✓

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focused on reducing pedestrian fatalities over the next 10 years.								
Develop a pedestrian and bicycle safety plan/program evaluation method that reviews elements of the state's program and makes recommendations for improvement; include an online and in-person review process using subject matter experts.	X	✓	✓	✓	✓	✓	✓	✓
Develop law enforcement training on bicyclist and pedestrian safety with input from law enforcement reflecting current issues.	X	✓	X	X	X	X	X	X
Identify discrepancies in how new pedestrian and bicycle facilities are designed to be used versus how they are actually used by pedestrians, bicyclists, and motorists by examining knowledge of proper facility use, enforcement efforts, and documenting available educational resources and initiatives.	X	X	X	X	X	✓	✓	X

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