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Danube Transnational Programme
RADAR

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**Your Road Safety is on our
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O3.3b STUDY VISITS

**THEMATIC AREA 2: PROVISIONS FOR VULNERABLE ROAD
USERS**



RADAR – Risk Assessment on Danube Area Roads



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Abbreviation list

AAADT	Annual Average Daily Traffic
AMZS	Avto-moto zveza Slovenije (Slovenian auto-moto club association)
DARS	Slovenian motorway operator
DTP	Danube Transnational Programme
EuroRAP	European Road Assessment Programme
FPZ	Faculty of Transport and Traffic Sciences, University of Zagreb
HAK	Hrvatski Autoklub (Croatian auto-moto club association)
HC	Hrvatske Ceste (Croatian road infrastructure operator)
HGV	Heavy Goods Vehicle
iRAP	International Road Assessment Programme
RADAR	Risk Assessment on Danube Area Roads (DTP project)
VRUs	Vulnerable Road Users

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Executive Summary

RADAR project Partners, Automobile and Motorcycle Association of Slovenia (AMZS) and University of Zagreb, Faculty of Transport and Traffic Sciences (FPZ) organised a first Study visit, dedicated to Thematic area 2 – Provision for vulnerable road users (VRUs), particularly pedestrians and cyclists.

The event organized on March 28-29, 2019 in Zagreb and Ljubljana brought together road safety specialists, public infrastructure operators and academic researchers, aiming at demonstrating and discussing the projects realized recently in sub-urban and urban areas of the two cities in order to increase safety and infrastructure provisions for VRUs.

While the Croatian part introduced an individual project of upgrading the main through-road of the city of Karlovac in terms of pedestrian safety after a tragic and largely medialized fatal accident of a small boy, the Slovenian part presented, how multiple measures to upgrade facilities and improve movement of cyclists in the Ljubljana city centre helped to support the implementation of city centre access restrictions for individual car traffic. Besides that, study visit participants had a chance to visit a newly upgraded pedestrian crossing at a suburban collecting road exposed to high traffic volumes.

The first RADAR study visit has fully met the expectations and purpose, as it demonstrated, how various EuroRAP methodological tools and knowledge can be easily put to practice and, as a result, how low-cost, quickly realizable measures can significantly help to reduce risk on roads, especially as it goes to safe movement of VRUs in urban and sub-urban environment.

1. Study visit itinerary

First study visit of RADAR had been prepared as a 2-day event, enabling the participants to visits road safety upgrades for VRUs in both Croatia and Slovenia. Below are the itineraries of both days.

Thursday 28 March	
7:30 – 9:30	Transfer from Ljubljana to Zagreb
9:30 – 11:00	Presentations at the Faculty of Transport and Traffic Sciences <ul style="list-style-type: none"> - Welcome note - Road safety in Croatia - Introduction to the Turanj (Karlovac) case study - Presentation of road safety measures taken within the Turanj case study - Questions and discussion
11:00 – 12:15	Transfer to the Turanj site
12:15 – 13:00	Guided site visit in Turanj
13:00 – 17:30	Lunch and transfer back to Ljubljana

Friday 29 March	
8:00 – 8:30	Welcome note at AMZS
8:30 – 9:30	Cyclist provision in downtown Ljubljana (advanced stop line/bike box, bike sharing, shared space)
9:30 – 10:30	Upgraded pedestrian crossing 'Šentjakob pri Ljubljani'
10:30 – 11:30	DARS - Motorway Control Center
11:30 – 12:30	Transfer to Vransko
12:30 – 14:00	AMZS CVV Vransko - Safe Driving Programs for motorcyclists
14:00 – 14:30	Conclusion - questions and discussion
14:30 – 15:00	Transfer to Ljubljana

2. Case Study 1 Introduction

First day of the study visit brought participants to Zagreb, where FPZ team, together with Mr. Viduka of HAK and Mr. Babic of Croatian road authority Hrvatske Ceste (HC), presented a recent project of major upgrades to pedestrian facilities along a busy state through-road in Turanj, suburbs of Karlovac.

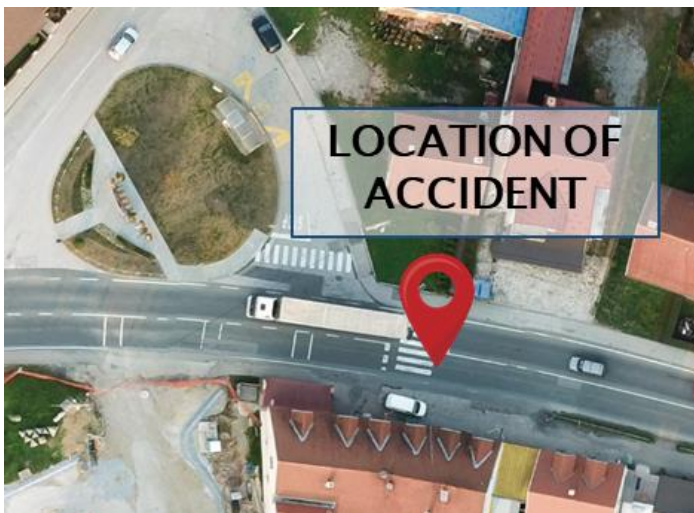
Based on intensive public pressure raised after a fatal accident involving a 10-year-old boy, who died, while trying to cross the road on his bike and being hit by a passing truck, FPZ was approached by HC with a request to analyse the safety of existing pedestrian and access facilities and propose suitable countermeasures.



Accident characteristics:

- Friday 12 October 2018;
- afternoon, sunny, good visibility;
- state road DC1;
- 1x HGV;
- 1x cyclist;
- **1x fatality.**

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2.1. Objectives

As indicated, the major goal of the DC1 Turanj project was to identify existing shortcomings and safety risks in the provisions for VRU and general traffic management along this busy main road with lots of access points (either to residential or commercial developments) and, in the next phase, to come up with efficient countermeasures, which shall be implemented in short/mid/long term.

In addition, special focus was given to design conditions for safe movement of children around the municipal school, which is located in the middle of the problematic section.

2.2. Implementation process

Following the assignment from road authority, FPZ has carried out the safety assessment of the 800m DC1 stretch in Turanj in several stages:

Data analysis

Historical data, as well as data obtained from the field analysis and surveys were used to identify traffic conditions and infrastructure:

- traffic flow (automatic and manual counting);
- traffic flow speed (automatic counting);
- pedestrian and bicycle traffic load;
- heavy vehicle transit share;
- analysis of historical traffic accidents data.



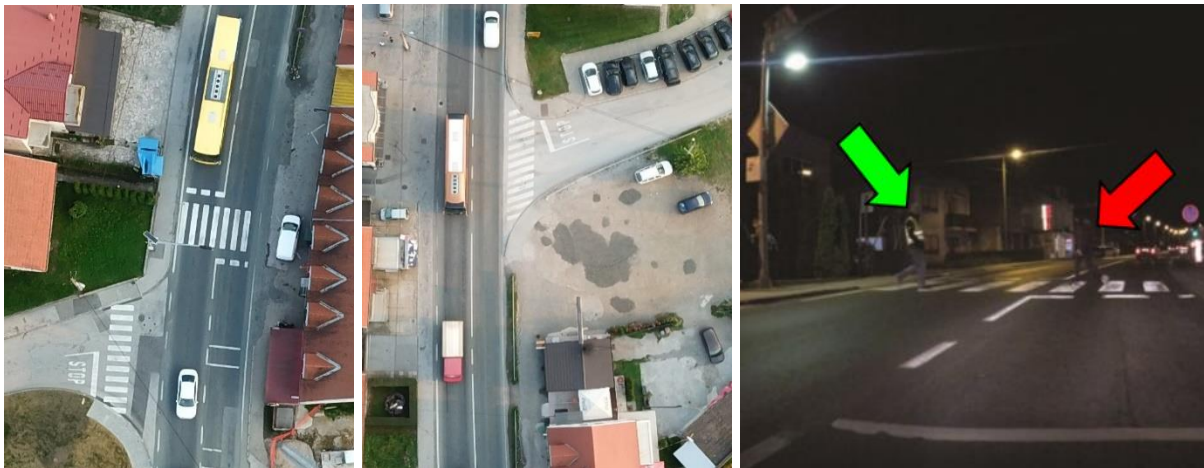
Day of the week	Location	Number of vehicles	Number of vehicles in peak hour (3 p.m. – 4 p.m.)
Friday (peak day)	L1	16.904	1.272
	L2	15.946	1.272
	L3 (school zone)	15.024	1.174
	L4	14.169	1.117
Wednesday (characteristic day of the week)	L1	14.115	1.048
	L2	12.372	956
	L3 (school zone)	11.536	891
	L4	10.685	843

Both historic and observed traffic volume data clearly show that Turanj is a very busy location. DC1 road represents the shortest connection of Slovenia with Bosnia and Herzegovina and is frequently used by trucks trying to avoid the tolled motorway network. Official automatic traffic counts show around 10% share of heavy vehicles in traffic flow. Below is the sample of the counting carried out manually at the specified locations during the assignment.

Road survey

The key part of the road survey was the analysis of existing infrastructure provisions and identification of major shortcomings, especially those impacting negatively safe movement of VRUs in the area. Some of the key findings include:

- lack of sidewalks around shopping areas;
- access to private parking areas interfering with pedestrian flows;
- wide traffic lanes (3.5 m in average, frequently even more);
- insufficient visibility of pedestrian crossings at night;
- violation of traffic rules by motorized traffic (parking habits and stopping for quick shopping, lack of enforcement measures).



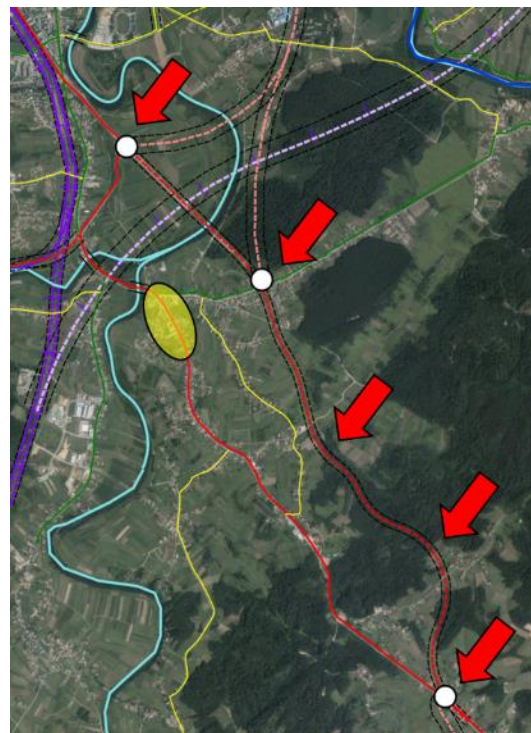
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Proposal for countermeasures

Based on the analytical exercise, FPZ worked on the development of proposal for effective countermeasures to improve the present situation along DC1 in Turanj. Recommendations included actions to be taken in both short and long term.

Long-term measures:

- reduction of traffic by completion of additional 6,2 km of the existing Karlovac bypass;
- significant financial cost, political will needed;
- long implementation period.



Mid-term measures:

- narrowing of traffic lanes;
- adding and/or widening of sidewalks;
- adding cycle lanes;
- longer implementation period and higher financial cost.

Short-term measures

- key objective of the project – immediate action as an answer to the public calls after the accident;
- set of engineering upgrades, which can be implemented in a relatively short period with low financial costs.



2.3. Countermeasures taken

To search for effective and economically viable solutions to improve safety of VRUs in Turanj, FPZ turned to the extensive professional technical library of iRAP and, based on the safety assessment carried out earlier, proposed the following set of countermeasures to be implemented immediately onto the town through-road.

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After the accident, FPZ proposed the following short-term measures.

- **Speed enforcement cameras in the school zone**

To strengthen the surveillance and identification of vehicles over-speeding the limit of 50 km/h (option of lower speed were not found relevant due to the traffic volumes).



- **Measures to eliminate on-street and on-sidewalk parking: bollards, sidewalk parking tickets**

In order to prevent drivers from frequent stopping at pedestrian facilities, blocking accesses and safe passage, while increasing risk of collision at numerous spots along the through road (close to school, shops and services), bollards and pedestrian fencing was used to separate pedestrian flows from other traffic and disable fraudulent parking. With these, enforcement through penalty tickets was introduced.



- **Increased visibility and quality of crossing facilities**

Junctions and pedestrian crossings were equipped with improved signalization, measures also included improvements of visibility (new road markings and signing, lighting upgrades).



2.4. Critical issues

What appeared to be clear from the case study visit in Turanj, is that easy, quick and effective measures could have been prepared and physically realized thanks to a combination of several aspects being present.

- support of municipal authority when overcoming initial protests and objections against proposed measures (especially from local or frequently passing drivers) and promoting positive impacts of the measures;
- political willingness and drive to act quickly due to the public pressure raised after the fatal accident (protects of parents blocking the road);
- cooperative and progressive approach of the road authority (HC), who approached FPZ with a request to support and advice in this project.

3. Case Study 2 Introduction

The second day of study visits was dedicated to a bus tour around various VRUs facilities developments in Ljubljana. At first, participants were dropped in the city centre and enjoyed a guided walk around numerous recent installations and upgrades to provisions for cyclists.



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Implemented infrastructure measures simply represent another important step towards the strategic vision of Ljubljana as the city for people to live in, following the regulations in city centre access for personal cars.

After the city centre tour the participants were taken to the outskirts of Ljubljana, municipality of Šentjakob pri Ljubljani, where representatives of AMZS presented a recently completed project of upgrading pedestrian crossing, which helped to make a regular school route across a busy state road much safer.



The study visit also included a valuable excursion into the traffic management centre of DARS (Slovenian motorway authority) and AMZS Safe Driving Training Centre in Vrnsko, where participants learnt about training courses targeted specifically to motorcyclists, beside other interesting information.





3.1. Objectives

There were numerous projects and installations seen the Slovenian part of Study visit. Although their variety is great, the objectives of such projects have something in common – they aimed at improving the provisions for safe movement of VRUs in urban and suburban environment of the city of Ljubljana.

Ljubljana has been becoming a city friendly for its inhabitants, transforming step-by-step from the car-focused to human-focused. As the city implemented several major measures to reduce individual car traffic in the centre (access restrictions), further projects have been prepared to support cycling, as the environmentally friendly mean of transport. They aimed at providing attractive incentives for citizens to choose cycling instead of other motorized options.

In terms of the project of Šentjakob, the objective of the crossing upgrade was to provide safer conditions for crossing a busy state road. The spot is frequently used by local communities and is also part of the regular route to school for many children.

3.2. Implementation process

As there were many different projects presented in the Ljubljana city centre, it was not possible to explain in detail the exact implementation process of all. The tour rather was intended to present the “big picture” – strategic concept and decision of the city to favour sustainable forms of transport and lower the impact of motorized traffic in the centre. After such a strategy was implemented, individual projects have been introduced to increase public acceptance and willingness to change traditional mobility patterns.

As far as the Šentjakob pedestrian crossing project is concerned, the implementation was divided into 2 phases, each of which introduced a higher level of safety at the location:

1) Situation “before” – default layout



2) Installation of rumble (deceleration) strips



3) Full implementation – new layout with central refuge island



3.3. Countermeasures taken

Individual countermeasures and objectives of their implementation were shortly described and photo-documented in previous text. Below is the summary listing the most significant ones, all of which the Study visit participants had a chance to see.

- **Measures for cyclists and pedestrians in the city centre**

Numerous implementations typically include advanced stop line (so called “bike box”). At signalized junctions, those are frequently accompanied with advanced signalling phase (usually 4 seconds). The signal plan not only gives cyclists a time advantage but also protects them during the turning phase. Contrast lining or whole surface painting is often used, as well.



To promote cycling in the city centre, a brand new bike sharing system BICIKE(LJ) has recently been introduced in Ljubljana. It is very customer friendly and accessible at many locations across the city, and it proved to be quite successful, so that other municipalities around Ljubljana are considering to adopt the system, too.

Participants also visited Slovenska cesta, one of the major city trunk roads, that has been transformed from a busy 4-lane urban road (with dedicated public transport lanes) into a “shared use space”. Two lanes reserved for public transport remained, however, the rest has been transformed into wide pedestrian area. Bicyclists can ride in the bus lanes (where speed is limited to 30 km/h), as well as on pedestrian parts (where they have to respect the speed of pedestrian flows). Pedestrians can cross the road anywhere they want.



- **Measures at Šentjakob pri Ljubljani**

The process of upgrading safety of the pedestrian crossing in Šentjakob has been illustrated in the previous chapter so the measures can only be summarized at this point.

First stage of the upgrade introduced rumble strips to enforce deceleration of vehicles in front of the crossing, together with improved road marking and signing.

Second stage finalized the layout with a brand-new refuge island complemented with guard rail, which effectively eliminate potential collision points between pedestrians and traffic.

3.4. Critical issues

There were no specific criticalities related to different projects highlighted during the Study visit. It goes without saying that every infrastructure project finds its opponents or faces struggles during implementation. Slovenian study visits clearly showed that even large-scale, complex and politically difficult measures, such as city centre traffic access restrictions can be implemented successfully, in case strong cooperation and common understanding between respective stakeholders exist.

While one can imagine that the Šentjakob upgrade has been accepted very positively since the beginning of the project preparation, the measures undertaken in Ljubljana must have been based on a strong political support from the municipality and other municipal organization, as well as very well communicated towards general public.

In that sense, traffic access restrictions seem to be well accepted and welcome by inhabitants/visitors thanks to the fact that the city clearly works on provision of alternative transport options for the people in order to balance the discomfort of users from the restrictions.

4. Lessons learned

The study visit on provisions for vulnerable road users was the first exchange visit carried out within RADAR and it has clearly met the goals set in this knowledge exchange activity. The participants have learned about the process and results of many interesting projects targeted to pedestrians, cyclists, as well as school children.

Not only technical solutions are important, it is obvious from the experience that a lot of difficult conditions need to be met before implementing a simple project.

4.1. General key success factors

The following has more or less been touched before, but in order to summarize some of the important factors influencing the overall effectiveness and attractiveness of proposed solutions, one shall not forget:

- **Strong political support and commitment at all respective levels**

As the study visit revealed, things could be processed and implemented quite smoothly and swiftly, should the support of all stakeholders exist. Sadly, such decisions are often preceded by tragic events (accidents), which provide the first “push” to the authorities, even with the help of public pressure raised after such events. It would be positive to see more and more preventive actions and countermeasures – implemented according to sound network safety assessments, rather than fatal accidents. In this respect, iRAP methodology and technical protocols offer large variety of tools to do that.

- **Financial resources**

Available budgets (mostly public) is a vital precondition for any infrastructure investment. And as regards Danube area countries, it must be noted that public authorities do not usually put road safety measures on top of their priority lists. Many countries suffer from incomplete motorway networks, missing city bypasses and ring roads or low quality of regional road networks, and the governments (together with infrastructure operators) seem to allocate available resources accordingly.

And again, it can surely be highlighted, that there are analytical and engineering tools of iRAP, which can significantly help responsible stakeholders not only to identify major risks across the network, but – even more importantly – to prioritize the actions according to the most economically effective performance. In other words, the smaller budget is available for network safety management and improvement, the more iRAP expertise is needed.

- **Communication and promotion**

This aspect often tends to be underestimated but is very important, as it comes to general public awareness of planned investments, understanding the objectives and particularly the benefits of the project. There always is a small portion of entities affected negatively by an investment project, but it must clearly be explained, why the project is so important and how much it will contribute to higher quality of life for the vast majority. The Ljubljana city centre access regulations can truly be an example to follow in this respect. Good and early communication strategy might prevent many problems and negative campaigns from even being initiated.

- **Willingness to “do more”**

What the participants were also able to learn from the study visit is how helpful and good for the outcome is to think ambitiously and try to deliver more than the necessary minimum required by legislation. One can easily point out the implementation routines of Directive 96/2008 on road infrastructure safety management – some countries still apply the engineering procedures onto the “compulsory” TEN-T network only, others try to bring the same routines onto the lower-class national networks, as well.

The case of Turanj clearly demonstrated, how wise and strategically correct it was for Hrvatske Ceste to join forces with FPZ in the assessment exercise and bring forward the set of effective measures, which shall prevent any future tragedies from happening.

4.2. Potential for transfer across DTP countries

The study visit on provisions for vulnerable road users was very valuable in certain aspect. And it not particularly in the category of “WHAT”. The measures presented by responsible RADAR partners (AMZS+FPZ) are well known and proven ones. Is it rather the “HOW” aspect, which has been appreciated and valued, providing some insights to the implementation process, negotiations, cooperation and public acceptance. In these terms, the study visit was inspirational.

The knowledge shared is highly applicable in majority of DTP countries. Speaking of RADAR countries, analogical cases with persistent safety deficits can easily be found. Picking up some of them for each case presented during the 4 study visits will complement the messages of the final activity deliverable D3.4.1. Up to date, the RADAR partners delivered the following national exemplary cases.

4.3. Analogical exemplary cases observed in RADAR countries

4.3.1. HUNGARY

CASE 1

Location: 1117 Budapest, T-junction of Pázmány Péter Promenade – Magyar Tudósok Boulevard (GPS: 47.471580, 19.063967)

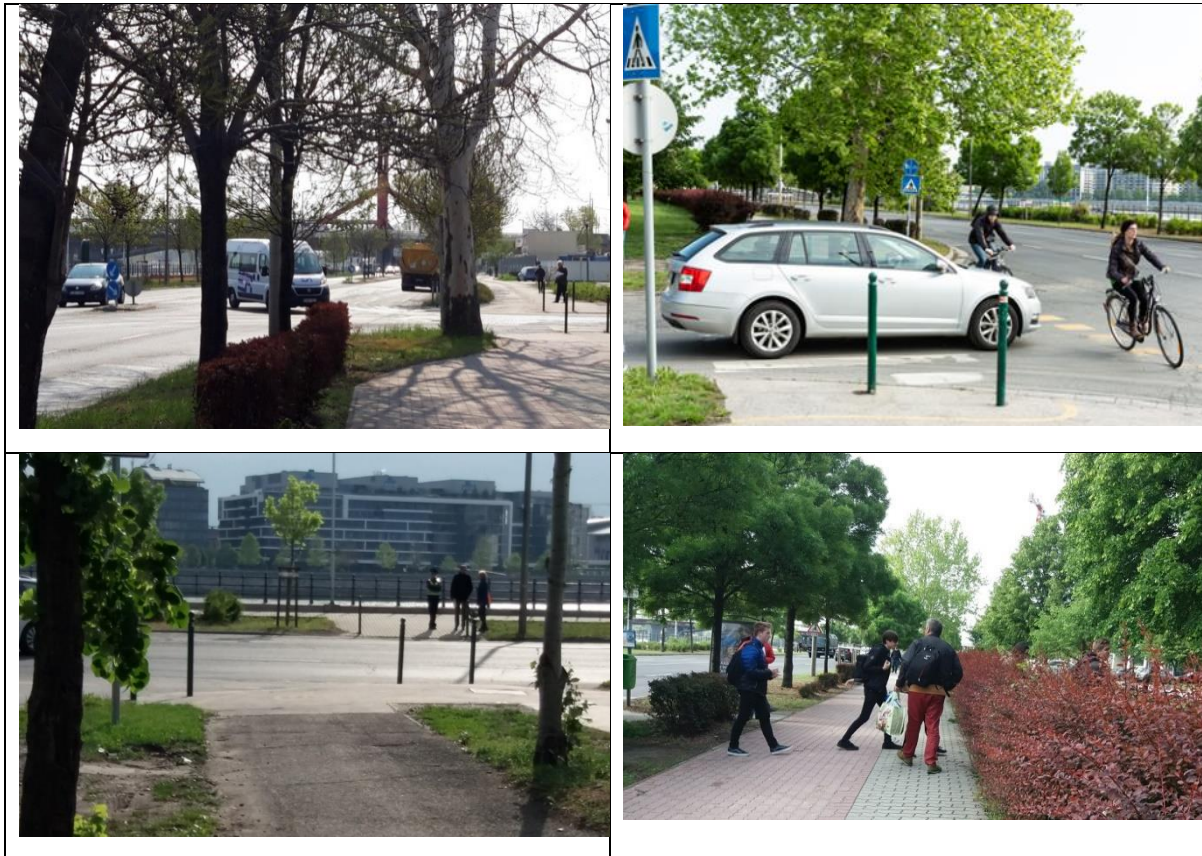


Figure 1: Photos of location, presenting some of the problems affecting vulnerable road users

This junction is an accident cluster which has been recently revised from road safety point of view (revision was led by the Road Safety Research Centre of KTI Non-profit Ltd.). The revision has been made as a teamwork, the problems and risks were examined from the perspective of the different road user groups (motor vehicle drivers, cyclists, users of public transport, pedestrians).

Figure 2 illustrates the site plan of the accident cluster and accident data from the last 3 years (2017-2019). Out of the 4 accidents from the subordinate direction, 3 accidents (crossing collisions between cars and cyclists arriving from the right on the bicycle path) occurred during a construction, when the bicycle path was covered by a 2-meter-high wall, which negatively affected the visibility of the cyclists (these 3 accidents are special cases, they were the consequence of a temporary problem).

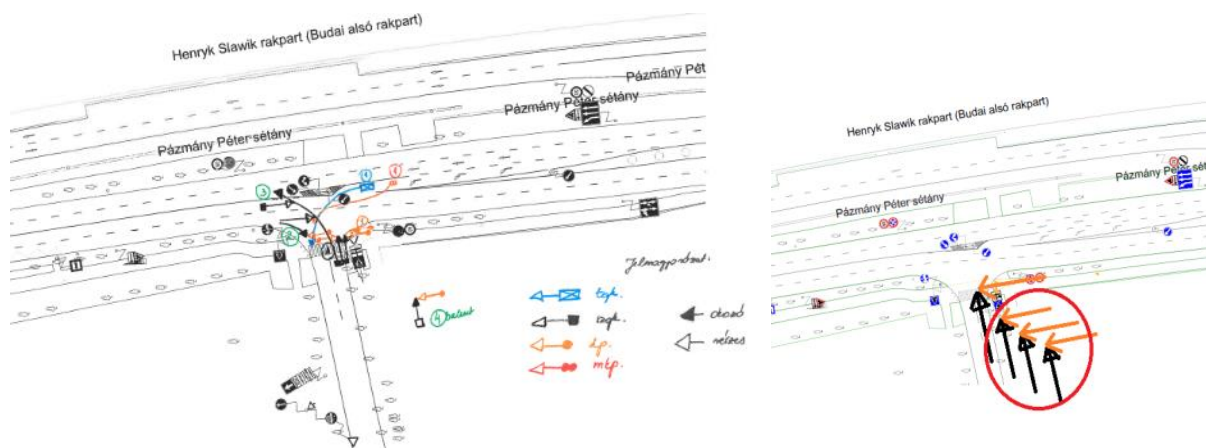


Figure 2: Location and type of accidents at the site (2017-2019)

Characteristics of the site, exploration of road safety problems:

- Pázmány Péter Promenade has 2x2 lanes, speed limit of the main direction is too high: it is a section with raised speed limit (60 km/h), where vehicles often are driven at 70-80 km/h.
- Increased speed affects negatively the traffic flow in the junction, the traffic is pulsating.
- To enter in and join the traffic flow from the subordinate direction (Magyar Tudósok Boulevard) is very difficult, often depends only on the goodwill of those arriving from the main direction.
- The left-turn lane built in the main direction makes the geometry of the junction even more unfavourable, the design has been distorted.
- Demand of turning left among those who arrive from the direction of the Rákóczi Bridge (from the right in Figure 2) is high, the left-turn lane is often saturated, the line of the waiting cars is often longer than the left-turn lane.
- The precise turning manoeuvre (according to the lane) is often „cut off”, because of fleeing, hurried turns.
- Turning back is very common at the intersection, which is a network level problem, connections are lacking.
- The triangle of vision is not ensured from the Magyar Tudósok Boulevard, you have to stand on the bicycle pass, therefore traffic trying to join have conflicts with the cyclists.
- The two-way bicycle path parallel to Pázmány Péter Promenade has a high traffic volume and is dynamically used by cyclists.
- The “cutting effect” of the Pázmány Péter Promenade is very strong; it is risky for the pedestrians and cyclists to cross it.
- Pedestrians leaving the public transport vehicles (buses) arrive at the bicycle side of the separated pedestrian and bicycle path and do not use the sidewalk, they cut through the hedge.

The recommended solutions are illustrated in Figure 3. Recommendations include traffic attenuation, geometric correction, enhancement of visibility and perceptibility as well as revision of traffic signs:

- Reduction of the raised speed limit (60 km/h) to 50 km/h.
- The road towards the Rákóczi Bridge should be narrowed to only one lane, ensuring a better traffic flow from the subordinate direction. The narrowing should be done so that the unfavourable geometry is corrected ensuring space for at least one car between the cycle path and the edge of the main road.
- Emphasize the priority of the bicycle lane by painting the cycle pass red.
- Instead of "bicyclists danger" traffic signs, a "two-way bicycle path on one side" traffic sign should be displayed.
- Ensuring the visibility of the separated pedestrian and bicycle path, improving perceptibility of pedestrians and cyclists by keeping the hedges low.

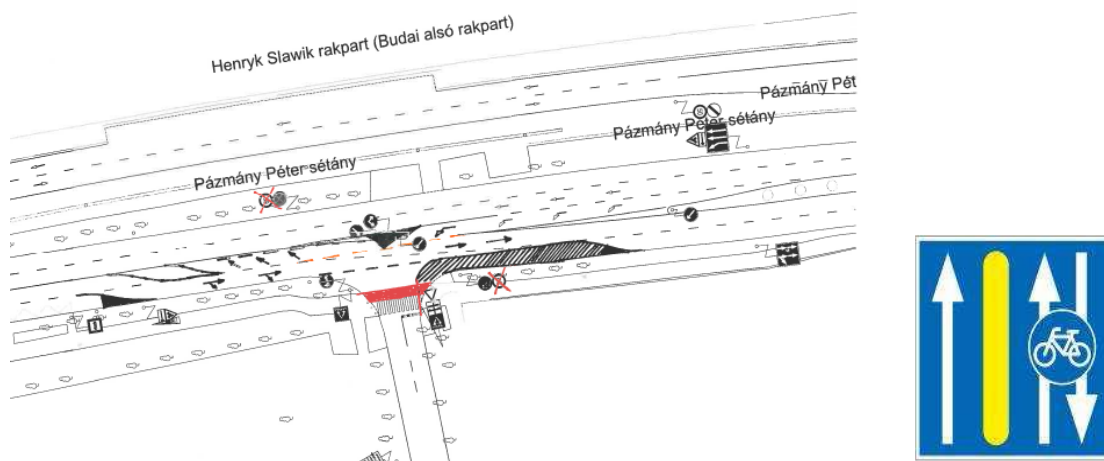


Figure 3: Proposed solution to reduce road accidents

CASE 2

Location: 9330 Kapuvár, pedestrian crossing at Road Nr. 85, 42+850 km.

(GPS: 47.591878; 17.034577)



Figure 4: Photos of location

The pedestrian crossing in question can be found in the western part of the country in the city of Kapuvár. The crossing and its close environment is dangerous, 2 fatal accidents (pedestrian hits), and several accidents with serious and slight injuries occurred in the last 3 years (see Table 1).

Table 1: Data of road accidents at the examined site (2016-2019)

Date of accident	Nr. of road	Road section	Nr. of fatalities	Nr. of seriously injured	Nr. of slightly injured	Type-group of accident
2016.09.14. 14:55	85	42+700	0	1	0	crossing collision of vehicles
2016.12.12. 18:06	85	42+848	1	0	0	pedestrian hit
2017.07.20. 10:58	85	42+900	0	0	1	collision of vehicles moving in the same direction
2017.10.03. 15:38	85	42+907	0	0	1	collision of vehicles moving in the same direction
2018.01.10. 5:15	85	42+860	0	1	0	crossing collision of vehicles
2019.02.01. 6:40	85	42+859	1	0	0	pedestrian hit
2019.03.30. 8:50	85	42+750	0	0	2	collision of vehicles moving in the same direction

Characteristics of the site, exploration of road safety problems:

The examined pedestrian crossing is in fact the pass of the common pedestrian and bicycle path which is parallel to the main road Nr. 85. However the problem is that the bicycle pass is missing. The pedestrian crossing lies in an inhabited area; there is a T-junction near it (with a “STOP” sign on the subordinated road called Berg Gusztáv street). On the main road there is a left-turn lane, and a receiving lane to facilitate the traffic flow. At the pedestrian crossing, there are pedestrian-protective pillars, which is an unusual solution and has been implemented because of the cyclists, forcing them to get off the bike.

The common pedestrian and bicycle path can be found on the south side of the main road and typically used by cyclists (also in some cases by riders of electric bikes and mopeds). From the direction of the common pedestrian and bicycle path there is a “STOP” sign for the cyclists. From the east direction, the street lighting can only be found on the south side of the road, while after the pedestrian crossing it can be found on both sides of the road (the changing point is exactly at the pedestrian crossing, see Figure 5).



Figure 5: Photo of location at night

The common pedestrian and bicycle path is not luminous, while the parking lot of the shopping centre at the north side is luminous.

From the east direction on the main road, the turning vehicles from Berg Gusztáv street occasionally cover pedestrians intending to cross. From the west direction on the main road there are two lanes (inner is a left-turn lane while the outer is for those who drive straight forward). The perception of pedestrians coming from the right is not obstructed, but pedestrians and cyclists coming from the left can be covered by vehicles waiting to turn left.

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The surrounding road section is rehabilitated, there are good quality road markings warning of the danger of pedestrians, there are slowing transverse stripes and “Pedestrian crossing” signs with yellow background and flashing traffic lights for both directions.

On the main road the rate of HVGs is relatively high (above 10%), average speed of the vehicles is too high due to the construction features and straight lanes.

As mentioned, there are many traffic engineering solutions implemented at the site to make it safer. However, the fatal accident occurred in 2019 points out that there are still some problems. We propose the following solutions to improve further the safety of vulnerable road users:

- Introduction of a speed limit of 30 km/h on the main road Nr. 85.
- Changing the distribution of lighting columns, installing at least one additional lighting column at the north side of the main road, illuminating the entire junction.
- Improving the street lighting on the south side of the main road, so that the common pedestrian and bicycle path would also be illuminated, facilitating the perception of pedestrians and cyclists.

It has been considered the most important thing to improve the illumination of the pedestrian crossing as both fatal pedestrian hits occurred when the visibility conditions were limited (before sunrise or after sunset).

4.3.2. CROATIA

Location: Town of Blato

A combination of infrastructural shortcomings, poor visibility and speeding on Karlovačka cesta in Blato, Croatia, a traffic accident occurred where a girl lost her life while crossing the road when a personal vehicle hit her.

An analysis of the existing situation found that there is no adequate infrastructure for the safety of pedestrians while the cycling infrastructure is completely missing. Since the road section in question is in a populated place with a higher intensity of movement of vehicles and pedestrians, it is necessary to improve traffic safety especially, for vulnerable road users.

According to the existing state, the width of the traffic lanes is 3.6 meters on average (on certain sections up to 4.0 meters). Such dimensions of the traffic lane encourage and enable the development of higher speeds which significantly increases the risk of traffic accidents. Also, at the observed road section of the Karlovačka cesta while approaching the pedestrian crossing, the speed limit is 40 km/h which, due to the lack of visibility and stopping distance, poses a danger to pedestrians.

With the above mentioned, the necessity of reducing the speed limits or relocating the pedestrian crossing on the relevant road section of the Karlovačka cesta has also been established. Namely, by analysing the visibility and stopping distance on this critical intersection (*Figure*), a minimal visibility distance of 29.2 m and the stopping distance of 29.4 m has been established which requires a speed limit of 30 km/h, allowing a timely stop of the vehicle in case of pedestrians.

As a long-term improvement in traffic safety on the subject road section, it is proposed to narrow the traffic lanes to 3.0 meters by widening the central line and by widening the sidewalk. This would improve the visibility of the curve and enable timely detection of pedestrians. This measure would also result in deviation of the vehicle's path, which results in a reduction in operating speeds and an increase in the driver's vigilance, thus improving the safety of all traffic participants, especially pedestrians.

In order to increase safety, it is recommended to set up optical white lines for visually warning drivers, zig-zag lines or audible warning lines when approaching the pedestrian crossing. Increasing safety is also suggested by upgrading existing vertical signaling to ensure its better detection. This can be achieved by increasing the retroreflectivity of traffic signs by fluorescent backgrounds or blinking lights.

Figure shows a view of potential infrastructure upgrades in order to raise the safety of vulnerable road users.



Figure 6: Inadequate visibility in the curve

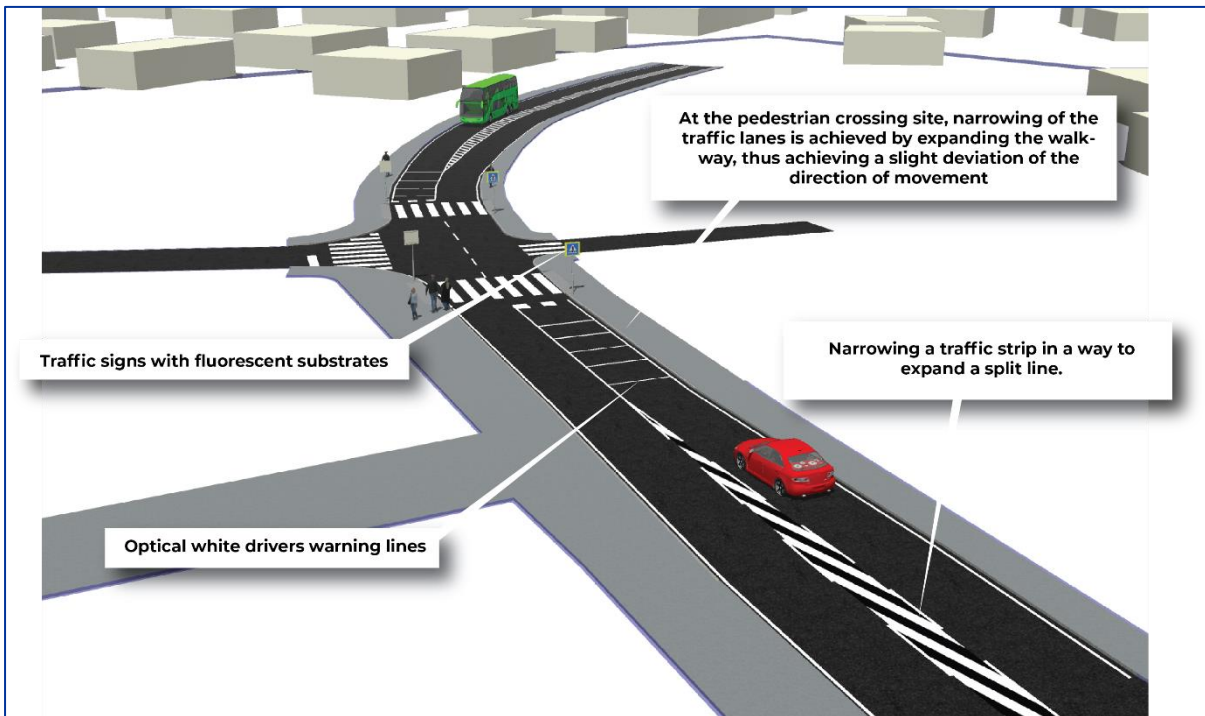


Figure 7: Potential infrastructure upgrades

4.3.3. CZECH REPUBLIC

Location: Town of Olbramovice – class I through-road I/3

Class I road no. 3 represents one of the highly loaded Czech single-carriageway arteries, which has been carrying long-distance traffic instead of missing motorway D3 (under construction in several South Bohemian section but majority still missing).

As a consequence, many municipalities located on the existing I/3 road suffer from high traffic volumes (almost 30.000 vehicles per day), large portion of heavy vehicles and significant air pollution. Since the road safety condition and provision of facilities for vulnerable road users along the I/3 through-sections is going to be the subject for Czech pilot study to be elaborated within RADAR project WP5, the following exemplary case illustrates one of such sections, probably the most controversial and escalated both publicly and politically – the town of Olbramovice.

In long-term, a regular bypass of Olbramovice is planned but suffers from many procedural and administrative obstructions in the decision-making process, which have been delaying the issue of building permit.

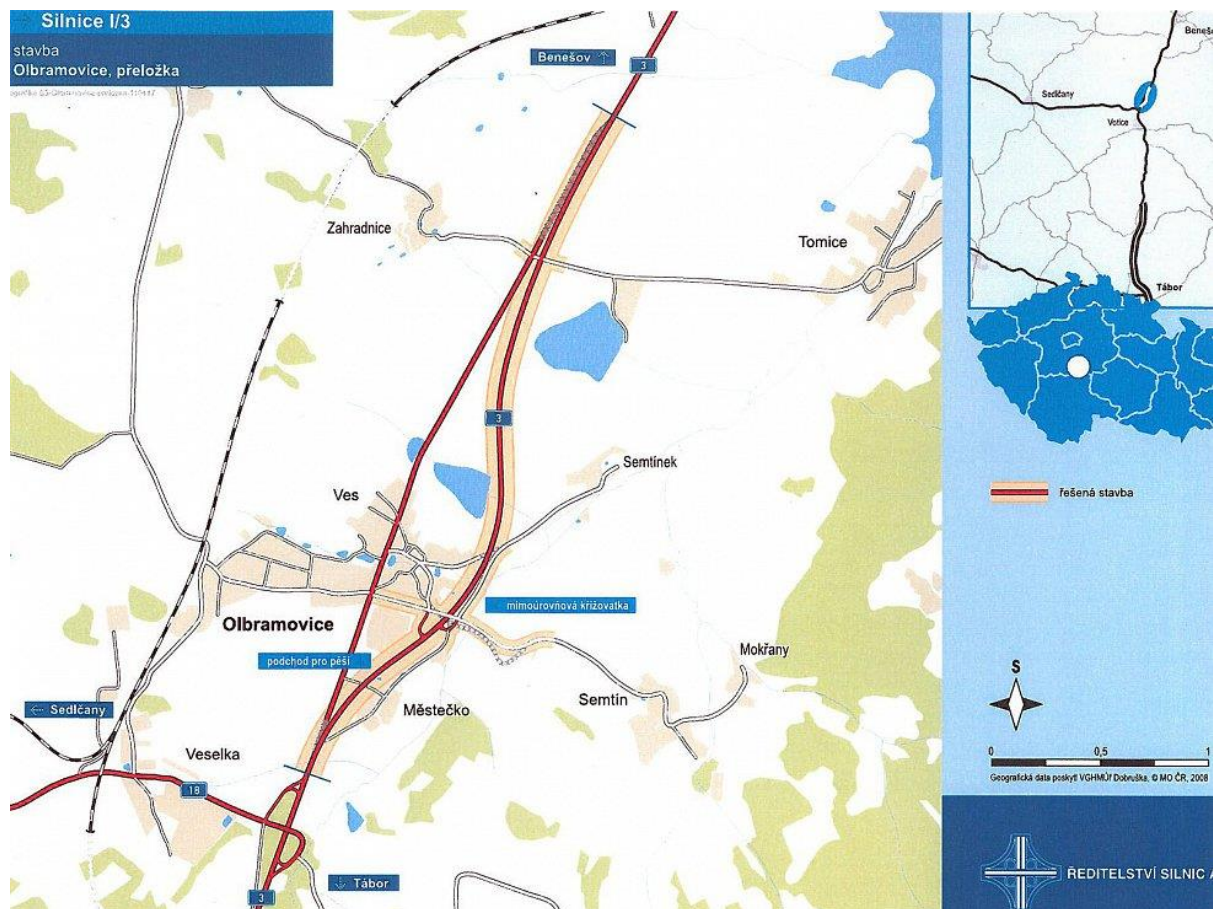


Figure 8: Location of Olbramovice and routing of its future bypass



Figure 9: Daily traffic situation in Olbramovice

The bypass project has been postponed for so many times that it raised significant public pressure on respective authorities. Similarly to the case of Turanj, local protests against the neglecting and postponing decisions of various authorities appeared in the past. At latest, the inhabitants raised their voice against the verdict of Ministry of Transport, which in summer 2019 cancelled the building permit issued by the Central Bohemia Region Authority in 2017 for mistakes in administrative procedures.



Figure 10: Local protests requesting the acceleration of the bypass project realization

But one thing remains different from the Turanj case – there still has not been anyone killed so far. It is therefore a question, whether the decision makers will watch how traffic threatens lives in Olbramovice for the more 10+ years, waiting for a tragedy to happen, or whether they will initiate certain low-cost countermeasures to make the movement of people along and across the main road much safer. There is no such a project under preparation yet and RADAR WP5 pilot shall take a look at potential actions for Olbramovice, too.

The pictures below illustrate the state-of-the-art condition of provisions for VRUs, which is insufficient and not convenient enough to make locals use it, resulting in risky situations in traffic.



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Figure 11: Pedestrians in Olbramovice

4.3.4. BOSNIA AND HERZEGOVINA

Location: Intersection - Skenderija, Sarajevo

The map below shows location that is dangerous for the vulnerable road users.



Figure 12: Skenderija, Google maps

This street consists of three traffic lanes and one tram lane. Speed limit of this section is high 60 km/h where vehicles often are driven at 70-80 km/h, especially at night.



Figure 13: Photos of location, Skenderija

The problem comes in situations where pedestrians or cyclists are "hateful" to make the round to cross the intersection and because of that they run across the road and endanger their own lives, as shown on the photo below.



Figure 14: Pedestrians and cyclist crossing the road

In the picture below we can see the proper way of crossing the road (line 1) and improper (line 2) that use many of vulnerable road users. We can see that the line 2 is shorter and faster but it's more dangerous.

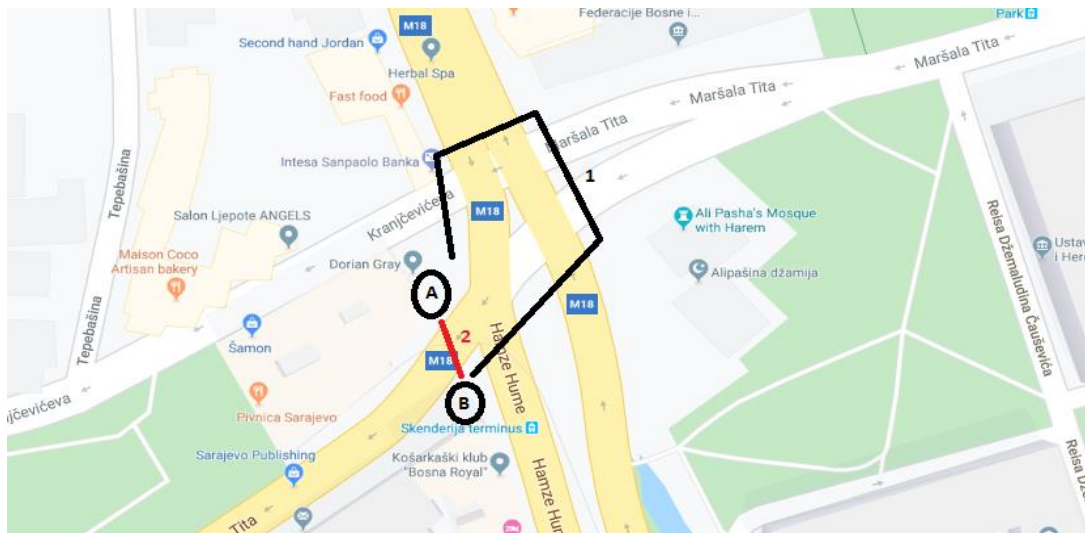


Figure 15: Proper and improper way of crossing road

To increase safety, we propose fencing to prevent vulnerable road users from crossing the street and thus improving their safety at this intersection.

Location: Kolonija, Konjic

The M17 main road passing through the populated town of Konjic is a very congested road with an AADT of 10.000 vehicles per day. Road section is in populated place with high intensity of movement of vehicles and pedestrians, cyclist, etc, and it is our duty to improve traffic safety on this road.



Figure 16: M17 – Konjic

The road consists of one carriageway with two traffic lanes. M17 connects the northern and southern parts of Bosnia and Herzegovina and it's one of the busiest sections with high traffic volumes and large portion of heavy vehicles.

On this road a few years ago light signaling was installed, however, it has not been in operation for a long time.

Speed limit on magistral roads at populated areas is 50 km/h, but vehicles are driven with 20-30 km/h more. In some cases the speed of some vehicles is even 100 km/h.

The visibility of pedestrians who want to cross the street is also affected by vehicles parked on the sidewalk, on the left or right.

On particular location Kolonija (Konjic) there have been fatalities, accidents with serious or minor injuries. The reasons for that are pedestrians that cross the road on an unmarked part and cyclists who use this road every day.

In the period from 11. to 17. of September 2018. three road accidents took place on this 200-meter road, in which two people sustained injuries. From September 2017. to May 2018., eight traffic accidents were registered and six people were injured.

On the night of 5th of May 2018., there was a car accident in which our 21-year-old girl was killed on the M-17 in Drecelj which binds to the road Kolonija.

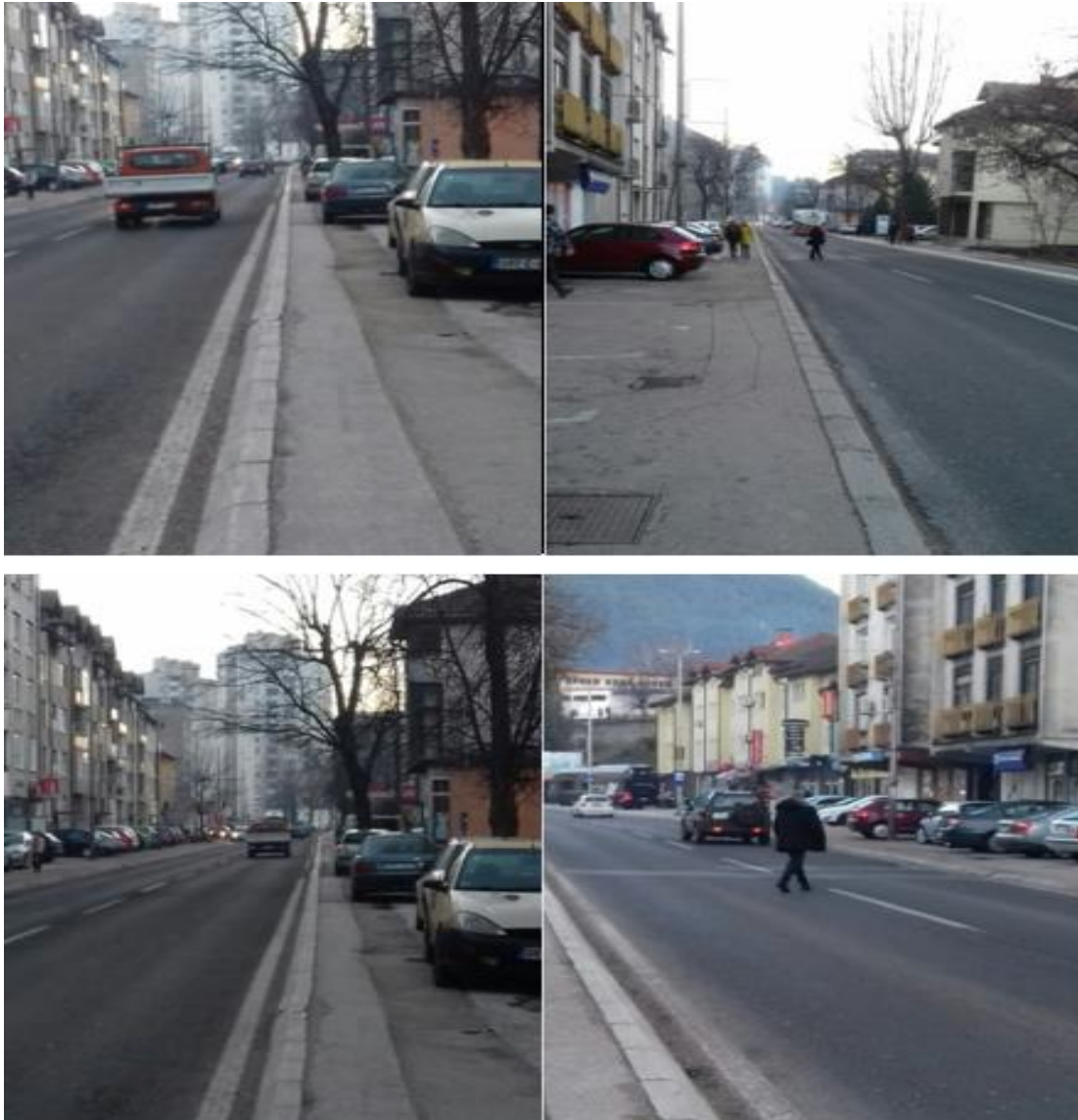


Figure 17: Photos of location, Konjic

At the beginning of the school year, this problem became even more pronounced, because from only three solitaires in this settlement, almost 100 students go to the First Primary School. This means that they risk their lives every day by crossing this road.

In 2018, we received a petition from citizens of Kolonija to resolve this problem and the competent service was informed. However, the situation is still unchanged.

PREDMET: MOLBA ZA STAVLJANJE U FUNKCIJU SEMAFORA NA MAGISTRALNOJ CESTI M17 ULICA KOLONIJA U KONJICU, OZNAČAVANJE PJEŠAČKIH PRELAZA ILI POSTAVLJANJE HORIZONTALNIH IZBOČINA (LEŽEĆIH POLICAJACA)

Poštovani,

Mještani konjičkog naselja Kolonija već godinama strahuju zbog nesreća koje se često dešavaju na magistralnoj cesti M-17. Samo protekle sedmice (11.-17.09.), na ovoj cesti, u dužini od 200 metara, desile su se tri saobraćajne nesreće, u kojoj su dvije osobe zadobile tjelesne povrede. Od septembra 2017 do maja 2018 registrovano je osam saobraćajnih nesreća prilikom čega je povrijeđeno šest osoba, a u noći sa 05.na 06.maj i saobraćajna nesreća prilikom koje je naša 21-godišnja sugrađanka smrtno stradala na magistralnoj cesti M-17, u naselju Drecejelj koje se veže uz Koloniju.

Naime, na magistralnoj cesti M-17 u naselju Kolonija, prije nekoliko godina postavljena je svjetlosna signalizacija, međutim, već godinama ista nije u funkciji. Označeni pješački prelaz na postavljenim semaforima koji nisu u funkciji, veoma je opasan jer na mjestu oznake, pješacima vozila prilaze sa tri strane, a vozači su nesavjesni i skoro nikada ne dozvoljavaju pješacima siguran prelazak te tom dionicom 99% njih vozi visoko iznad dozvoljene brzine.

Početak školske godine, ovaj problem je postao još izraženiji jer samo iz tri solitera u ovom naselju, u Prvu osnovnu školu ide skoro 100 učenika. To znači, da svaki dan rizikuju svoj život prelaskom preko ove ceste. Također, od naselja Drecejelj (ulazak u Konjic) pa do Raskrsnice na Trgu državnosti, ukupno su označena tri pješačka prelaza. Saobraćajni znak „ Djeca na putu“ nije postavljen, a vozači prebrzo voze.

Molimo da spasite našu djecu, i naložite popravku postojeće svjetlosne signalizacije, označavanje pješačke prelaze pored solitera i GAZPROM pumpe, ili, u najboljem slučaju, postavljanje horizontalnih izbočina - kako bi odlazak do škole za više od stotinu djece djece bio makar malo sigurniji.

Ovom prilikom želimo naglasiti da su na ovoj dionici kako djeca tako i odrasli već gubili živote u saobraćajnim nesrećama, mnogi su zadobili tjelesne povrede, pa vas molimo da zajedno sa nama pokušate spriječiti još jednu tragediju.

U nadi da ćete makar pokušati riješiti ovaj uistinu veliki problem mještana naselja Kolonija, upućujemo vam iskrene pozdrave.

MJEŠTANI NASELJA KOLONIJA - SOLITERI I, II, i III

Figure 18: Petition from citizens of Kolonija

To improve the safety of all road users and to reduce speed limit on this section the best solution would be a speedometer camera.