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MODERN ROAD SAFETY ELEMENTS OF THE PEDESTRIANS

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Abstract. More than 270000 pedestrians die annually on roads across the world, accounting for about 22% of the total number of people killed in road accidents. In addition, millions of pedestrians are traumatized, some of them become disabled for life. The pedestrian is the most vulnerable road traffic victim. Compared to drivers, they are not physically protected, and road accidents with their involvement often become a tragedy – usually the pedestrian gets serious injuries, including incompatible with life. The article contains a brief description of the pedestrian-driver relationship, the statistics of road accidents with the involvement of pedestrians in the Republic of Moldova, the modern practices and technologies applied in some countries regarding the efficient organization of the pedestrian safety.

Keywords: *pedestrian, pedestrian crossing, sidewalk, traffic attendant, road accident, artificial road roughness, resonant tapes, tactile indicators.*

Pedestrian, according to the Road Traffic Regulation, is the person who is on the road outside the vehicle and does not carry out work. Most pedestrians are walking people, walking to or from work, school, shop etc., doing physical activity, walking, cycling, cyclomotoring, motorcycling, snowmobiling, carrying a shopping carriage, baby stallers or wheelchairs for people with disabilities, so everyone at one point is like a pedestrian, even if some only for short periods of time.

Among the conflicts that take place in the traffic flow between the various traffic participants, there is also the „*eternal conflict*" between the driver and the pedestrian. To understand the essence of the conflict, perhaps, only the pedestrian who becomes the driver is able to. Such a person rightly appreciates the fluctuations of life and how unprotected the pedestrian is, and on the other hand, he understands the impossibility of stopping the car immediately in the event of unexpected appearance of the pedestrian in sight. It is very difficult to appreciate the level of danger and to understand the driver's way of thinking by the pedestrian without the experience of driving the car and without the essential knowledge of the Road Traffic Regulation. This is the main cause of the driver-pedestrian conflict issue.

One of the main issues that arise is pedestrian behavior. Usually, when walking, people choose the shortest way, and if they go with a well-established purpose, they do not want to consume too much time, so they often follow the rules to the extent they think it is necessary. The shortest route does not imply the mandatory use of passages or pedestrian crossings, especially if this means an additional walking distance. It may also fail to observe the red signal of the traffic light in case of longer waiting. In addition, pedestrians tend to pay less attention to traffic on familiar routes than in unknown circumstances.

According to the Road code, pedestrians are obliged to travel only on the sidewalk, footpaths or on the adjacent trails to the public road, and, in the absence of these, on the left side of the road, or, as close to the left edge of the road as possible, in the direction of the vehicles' flow, without disturbing the movement of vehicles, showing greater caution. In the case of traveling on the road or on the verge at night, or in low visibility conditions, pedestrians must wear fluorescent-reflective clothing. Pedestrians have priority over passage to vehicle drivers only when engaged in crossing public roads through specially arranged, marked and appropriately marked places, or the green pedestrian traffic light. The crossing of the public road by the pedestrians is done perpendicular to the axis of the road, only through the specially arranged and appropriately marked places, and in the absence of these at the intersections, on the sidewalks or moorings lines, only after they have made sure that they can do it without danger to them and for other road users.

On pedestrian crossings, regardless of their type, pedestrians have priority over vehicles. For this reason, there are pedestrians who consider that they have absolute rights on pedestrian crossing and are „*thrown*" practically from the sidewalk, on the road and without being insured in the absence of vehicles in the vicinity. In terms of choosing the shorter route, some of the pedestrians are not able to properly assess their physical possibilities and the danger, the speed of the cars, when they choose to cross through unauthorized places, as evidenced by the accidents caused by the surprise of the pedestrians for the „*suddenly appeared*" cars.

The mere existence of pedestrian walkways and pedestrian passages is not a guarantee of their efficiency. Physical measures that would limit the risky behavior of pedestrians, increase the attention of drivers and appropriate education in this regard are necessary. Last but not least, sanctions are very important, applied to both pedestrians and other road users. Many accidents have occurred in recent times on pedestrian crossings due to both inattentive drivers and unfavorable location for pedestrian crossings.

In this context, building pedestrian crossings in well thought out areas, even if drivers are being disturbed by them, is essential. Pedestrian crossings must be located in places that are already used by pedestrians. A good design of these is important for ensuring road safety.

An undefeated action of the pedestrian becomes a nightmare for the driver, because in 90% of cases for the pedestrian violations the driver is held accountable. This is because the law says the following: Even if the pedestrian has broken the rule, the driver must foresee his actions and refrain from admitting the road accident.

The driver must be prepared for any unexpected actions from the part of the pedestrians. Particular attention should be paid to children, older people and inebriant people, other undisciplined pedestrian, that break the traffic rules and intersect the roadway in places that are not allowed, near the moving vehicles. In such situations, the driver must show care, patience and goodwill in relation to them.

It should also be noted that:

1. Pedestrians are the largest category of traffic participants, characterized by lack of organization.
2. Some of the pedestrians do not know the traffic regulations. Other pedestrians know the Road Traffic Rules insufficiently and consciously violate them.
3. The pedestrian, who crosses the road and suddenly notices the vehicle, is, usually, lost and tends to turn back.
4. Older people are characterized by reduced mobility, hearing and poor vision, delayed reaction and inadequate responsiveness to the dynamic features of vehicles.
5. The group of pedestrians, waiting at cross the road, in the case of intense transport, poses a greater danger over a solitary pedestrian.
6. If at the edge of the road there are children, it must be taken into account that they are impatient and inattentive.
7. The field of vision for children is one third of the adult field of vision and often misrepresents the direction and speed of the vehicles.
8. Children can cross the road ahead directly in front of the vehicle, looking only in front of it.
9. Pedestrian use of umbrellas and the presence of hoods on the head limits visibility, and the noise of the rain disturbs the noise of vehicles.
10. In winter, the pedestrians worse hear the noise of the vehicles. They can also slip unexpectedly on the slippery road.
11. Behavior of inebriant pedestrians is unpredictable. They can unexpectedly change their way direction, or fall.

Road accidents involving pedestrians make up about 40% (during 2000-2018) of the total number of accidents (table 1). Most of the acccidents take place in localities. They are created in places of frequent pedestrian use: pedestrian crossings, routing stations, intersections etc.

Every road accident occurred every year (5357, or 10,75% of the total number of road accidents).

Table 1.

Frequency of road accidents (years 2000-2018)

The year	Road accidents in total	Road accidents involving pedestrians	% of the total number of road accidents	Road traffic accidents involving children	% of the total number of road accidents
1	2	3	4	5	6
2000	2580	1269	49,19	491	19,03
2001	2666	1237	46,40	496	18,60
2002	2899	1369	47,22	518	17,87
2003	2670	1289	48,28	440	16,48
2004	2447	1122	45,85	373	15,24
2005	2289	1041	45,48	342	14,94
2006	2298	1006	43,78	316	13,75
2007	2437	1054	43,25	360	14,77

Table 1. Continuation

1	2	3	4	5	6
2008	2875	1079	37,53	635	22,09
2009	2755	1066	38,69	536	19,46
2010	2930	1071	36,55	544	18,57
2011	2826	1006	35,60	564	19,96
2012	2712	935	34,48	557	20,54
2013	2603	980	37,65	485	18,63
2014	2564	886	34,56	411	16,03
2015	2527	831	32,88	357	14,13
2016	2479	835	33,68	387	15,61
2017	2640	997	37,77	371	14,05
2018	2613	946	36,20	414	15,84
Total	**49911**	**20019**	**40,19**	**8597**	**17,26**

Infringements committed by pedestrians who have caused more frequent road accidents have been:

- crossing the street without previously ensuring about the security;
- crossing the street in forbidden places;
- irregular traffic on the road;
- exit unexpectedly after vehicles, obstacles.

Road traffic accidents where children suffered were 8597 or 17,26% of the total number of road accidents, resulting in a loss of 602 children or 8,11% of the total, and 8757 children or 14,46% (figure 1) were traumatized.

Because of the children's own fault, 1810 road accidents occurred (figure 1), 114 children died and 1682 children were traumatized.

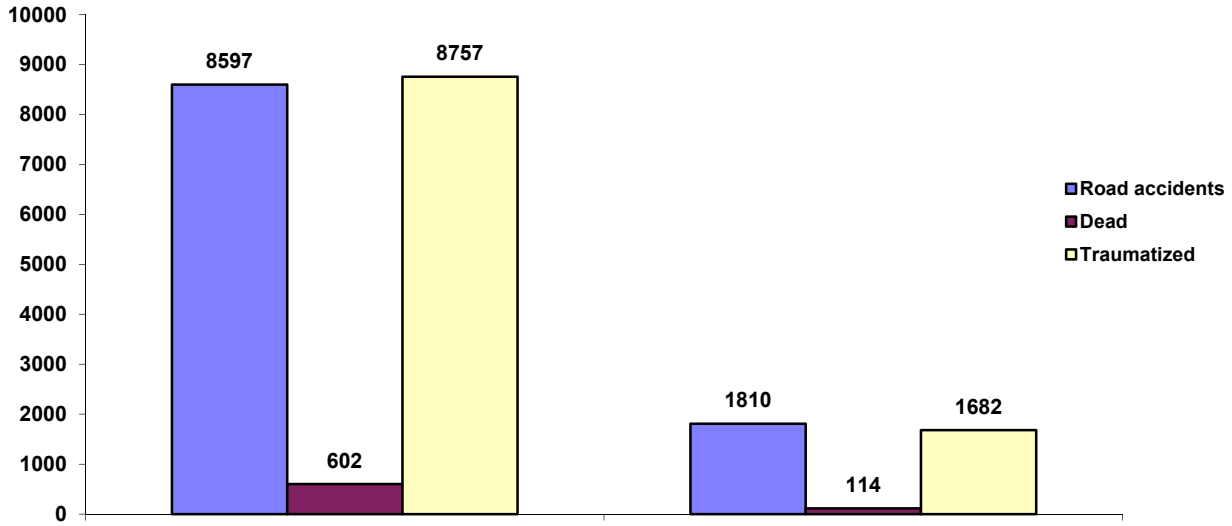


Figure 1. Children who have suffered road accidents (years 2000 – 2018).

Projects that are adapting the road to pedestrian traffic are multiple, mostly based on a general principle formulated by russian designer *Artemii Lebedev*: in order to reduce

the number of accidents on pedestrian crossings, it is necessary to highlight and illuminate not the indicator, but the person who crosses the road.

Air zebra (figure 2). According to the project, proposed by *Lebedev's* studio, a flashlight system hangs over the pedestrian crossing, which duplicates the road marking. Thus, the need for indicators is virtually gone, pedestrian and pedestrian crossing are illuminated and well-seen from afar, even when the road mark is not visible due to snow or mud on the road. Air zebra makes the crossing visible from afar at night and in other low-visibility conditions, illuminating pedestrians on the road, thus raising traffic safety.

Figure 2. „Air zebra".

Figure 3. Smart pedestrian crossing.

The *Cambrils* municipality of *Tarragona* province is the first city in *Spain*, where an „*smart*" pedestrian crossing has been built. The pressure sensors, directly mounted in „*zebra*", recognize the approach of the pedestrians and illuminate the *LED*s, located both on the road signs installed on both sides of the passage, as well as on the traditional mark on the road surface (figure 3): the objective consists in warning the leaders about the presence of pedestrians.

The „*Smart pedestrian crossing*" is the fruit of the *Urban Lab* project, where several solar-powered bus stations appeared in the catalan city, as well as a power station for electric cars. In addition, traffic lights were equipped with *LED*s.

The project is a part of the „*iCambrils*" plan, which involves the implementation of new technologies to improve the quality of life for citizens. Thanks to modern technologies, not only pedestrian and vehicle safety is raised, but a significant saving in energy consumption and the use of renewable energy sources is achieved.

In 2012, south korean designer *Khojon Lim* created another concept of „*Smart crossing*" – *Guardian* (figure 4), a little more difficult to build and implement, but quite visible.

According to *Lim*'s idea, the crossing area for pedestrians is limited by four columns, each of which is embedded with a laser beam generator. When the road is open for crossing, the red rays visually „*cut off*" the cars, serving as a visible but intangible barrier. When the red light burns for pedestrians, the beam separates people from the road.

Laser rays are also visible in the dark. The idea is not bad because it works at a psychological level: it is possible for someone not to run the red signal if a red line „*hangs*" in front of him at the chest level, thus saving his life.

In fact, there are a lot of other similar concepts – up to the „*intelligent*" illumination of each pedestrian, those who cross at green signal – in green, and the ones at the red signal – in bright red.

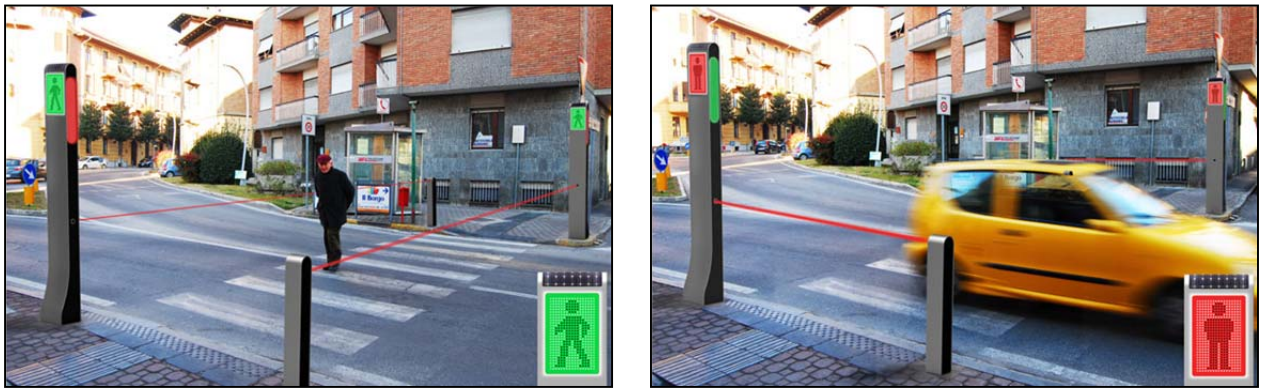
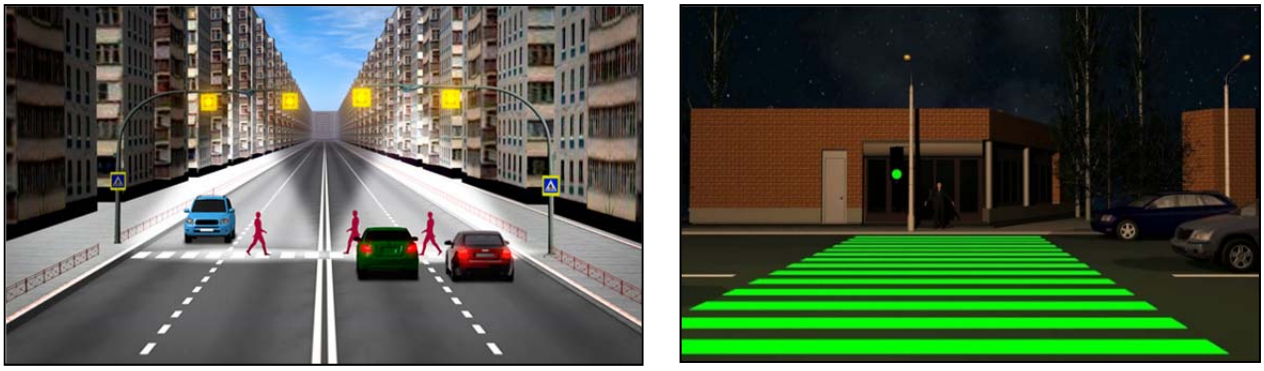


Figure 4. Inteligent crossing – *Guardian*.

Another idea of implementing the „*smart*" pedestrian crossing (figure 5, a) is to prevent the pedestrians, through a beep, from being aware of the danger on the road. For example, if an over-speeding car moves on the way to the pedestrian crossing, the „*smart*" pedestrian crossing begins to signal.

The algorithm for this pedestrian crossing takes into account the speed of the car, the road and climate conditions, the road clothing temperature. The system evaluates the likelihood of the car stopping in front of the pedestrian crossing, and if it is found that the car under the given conditions can not stop in front of the mark, the corresponding signaling is connected.



a) b)

Figure 5. Smart Pedestrian Crossing.

In the case when a man approaches a pedestrian crossing, light signaling is connected. During the day, only when the sensor records motion, the indicator illuminates and reaches the traffic light. If, for any reason, the sensor does not fire, it is possible to connect the illumination and the green signal of the traffic light by pressing a special doubling button. During the night additional auxiliary lanterns are also connected disconnecting them after 3,5 minutes after the pedestrian has left the pedestrian crossing.

The project also proposes to illuminate the road mark in the color of the traffic lights signal (figure 5, b).

Not once we did become witnesses of the situation when an inattentive or very rushed driver, talking on the phone or engaged in discussions with the passengers etc.,

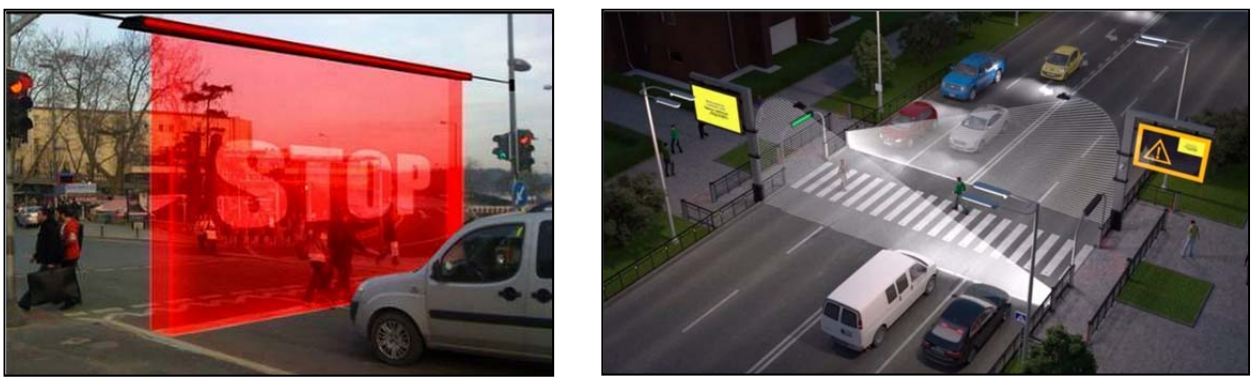
without observing the traffic light signal at the pedestrian crossing, endangered the life of pedestrians crossing the street . Designer *Hanyoung Lee* proposes the concept of laser design (figure 6) for pedestrian crossing to prevent the situation described above.

Figure 6. Pedestrian crossing with laser projection systems.

The idea is that laser projection systems are installed on both sides of the road in the area of the pedestrian crossing. After the traffic light signal is connected to ban cars passing, the laser system triggers and crosses the road to create an image of a network of people moving red contours. This image naturally draws the attention of the driver, who is distracted from the road, creating a kind of barrier between cars and pedestrians.

For non-compliant drivers, such a laser system can act as a sensor to fix the violation by activating the camera recording the violation and vehicle number. For drivers, however, who have stopped in front of the „*wall*" of the laser, images with a character of entertainment or advertising can be displayed on this wall, thus shortening the waiting time.

Another laser design concept directed at pedestrian crossings, provides for a red wall in front of the pedestrian passage, with the inscription „*STOP*", which visually restricts the passage of drivers (figure 7, a). A similar project, but for unruled pedestrians crossings was created by an inventor from *Kazakhstan* (figure 7, b). When approaching the pedestrian, the lasers illuminates the road marks and projects a luminous wall on the road, which visually blocks the way of the drivers. According to the creators, the walkthrough for laser pedestrians can work in any weather and time of day, being more useful at night and in low visibility conditions. The laser is not affected by rain, fog, wind and snow as well as temperature drops. The electronics work at both -50 °*C* and +50 °*C*. The system is powered by solar and wind power.



a) b)

Figure 7. Pedestrian crossing with laser design systems.

A group of creative architects, designers and creative technologists, collectively called *Umbrellium*, have developed a new vision of a pedestrian crossing known to everyone. *The Starling Crossing* project aims to create „*smart*" pedestrian passages (figure 8) to help people cross the road by drawing a real-time „*zebras*", as well as, stopping lines and signs for drivers, suggesting the moment of slowing down and stopping.

The prototype of this system was temporarily installed in southern *London*. The entire passage area is monitored by cameras, where images are stored in a neural network, capable of recognizing pedestrians, cyclists and vehicles. The network can also determine the location and speed of each traffic participant, allowing for the anticipation of their next steps.

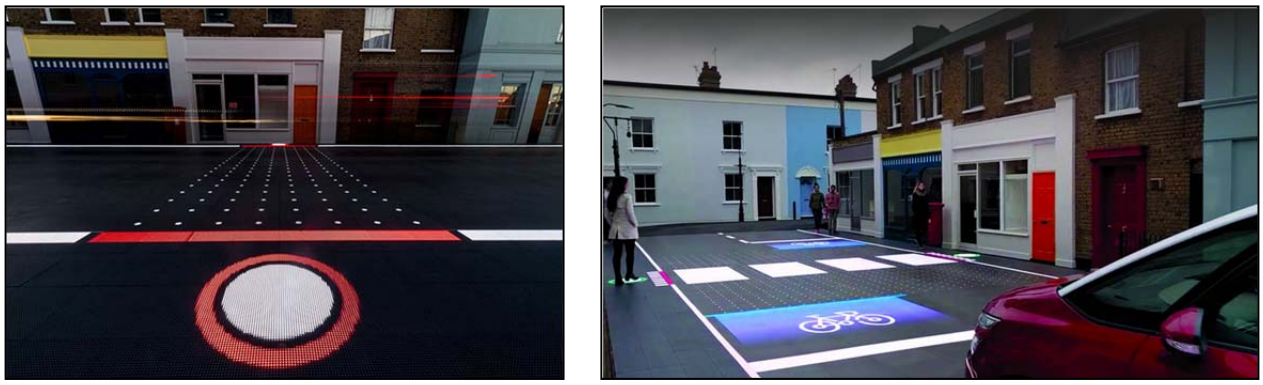


Figure 8. Crossing for intelligent pedestrians – *The Starling Crossing*.

The road surface in the pedestrian crossing area is designed to withstand the weight of any vehicle, and to prevent slipping, even in heavy rain. *LED*s are incorporated in the road, the light of which is visible from all directions at any time of the day. They trace the road marks along the way.

The system can only be programmed when it notices the pedestrian, or can increase the width of the passage to deal with the high traffic of pedestrians. It is noteworthy that the „*zebra*" is traced by the system at the last moment, which requires pedestrians to wait until all the cars stop. For pedestrians looking at smartphones, a separate function is invented. The system traces (draws) warning signs around them. This leads to the restoration of the pedestrians' attention and the safe passage of the road.

The developers of this project have noticed that the decision of many pedestrians to cross the road depends on the other pedestrians decision, who can choose risky ways and routes of crossing. Using special cameras located at each end of the street, the system's technological brain monitors the situation on the road section and includes *LED* panels to ensure pedestrian safety. The program can count the number of people on the roadside and can adjust the width of the pedestrian crossing. Cameras also respond to emergency situations, for example, a child who has gone on the road after the ball: the red arrows (figure 9) indicate to the driver the place where the child can reach the road.

No one likes to wait, so traffic lights and pedestrian crossings are considered to be some of the most dangerous places for pedestrians in town. In order to shorten and make the green signal of the traffic light more pleasant, *Smart* company has proposed an original solution to this effect, realizing it in the capital of *Portugal – Lisbon*, later, being taken over by other countries. The idea lies in the following: near the traffic light, which drives the traffic on a busy street, a large cabin is installed, where any one can enter, choose his

favorite music and starts dancing. All movements of the dancer in the cabin are immediately transmitted on the signboard and the red figure starts dancing (figure 10). The dance is broadcasted only at the red traffic light signal. If there is no one in the cabin, the traffic light works in the usual mode. As a result, instead of pedestrians trying to cross the road, regardless of the signal of the traffic light, they watch charmed the movements of the human figure on the traffic light. According to the study, more than 81% pedestrians stop at the red traffic light signal as usual.

Figure 9. Proiectul *The Starling Crossing*.

Figure 10. Semaphor „*dancer*”

All the modern innovations and technologies for pedestrian safety described above require enormous investment. An idea that requires fewer investments would be the use of simulators, such as resonant bands when approaching pedestrian crossing or artificial road roughness, replacing the usual pedestrian crossing marking and the one of artificial road roughness with a with *3D* one etc., that would require reducing the speed of traffic due to illusion.

3D Pedestrian Crossing (figure 11). Road safety has received a new dimension. Road markings from pedestrian crossing are made as optical illusions that give the impression that „*zebra*” is three-dimensional. The innovative design gives pedestrians the feeling of „*floating*” as they cross the street. Drivers, however, attract their attention and they reduce the speed they are moving. The idea is not a new one, being borrowed from *India*'s capital, *New Delhi*, where *3D* pedestrian crossings have been built to reduce vehicle speeds on the roads and to reduce the alarming number of accidents at pedestrian crossings. So dyed, passages give the impression that there are obstacles that can be tamped by cars, automatically causing speed reduction or even braking.

Figure 11. *3D* Pedestrian crossing.

Figure 12. 3D artificial road roughness.

An alternate of *3D* pedestrian crossings could also *3D* artificial road roughness (figure 12).

Resonant bands are means of lifting road traffic safety. When driving over resonant bands, the driver feels the significant impact of vibration and noise, which in turn contributes to increased traffic attention, warning of the proximity to a dangerous sector of the road, for example, pedestrian crossing.

Unlike artificial bumps, the resonant bands, without significantly affecting the suspension of the vehicle, generate discomfort for both the driver and the passenger, signaling an unfavorable traffic situation.

The application of resonant bands is recommended for the dangerous sections of motorways with increased traffic intensity, which require changing the speed regime or the direction of movement. On the streets of the city, the resonant bands are seldom used due to the fact that speed limitation of 50 *km/h* does not produce the expected noise and vibration effect.

Artificial road roughness is an element of forced vehicle speed reduction and one of the measures to alleviate road traffic. With the main purpose of reducing speeds of up to 30 *km/h* and lower, which is safe for pedestrians, it performs well, but it also has a number of disadvantages: the creation of traffic jams, especially on high-traffic roads; causing damage to vehicle suspension; increasing traffic noise; causing discomfort to the driver and passengers; causing problems for emergency services and road vehicles; distracting drivers' attention, thus ignoring other hazards, such as pedestrians; increasing air pollution in the area; increased fuel consumption etc.

To reduce the number of disadvantages listed, *Spain*'s *Badennova* manufacturer proposes a new innovation: fluid-based speed limiters (figure 13). When passing vehicles over the swelling of artificial road roughness at the speed prescribed by the indicator, it does not show resistance, therefore it does not cause damage to vehicles and discomfort to drivers and passengers. In the case when the driver exceeds the speed prescribed by the indicator, the viscous fluid hardens and becomes rough as a bitter asphalt.

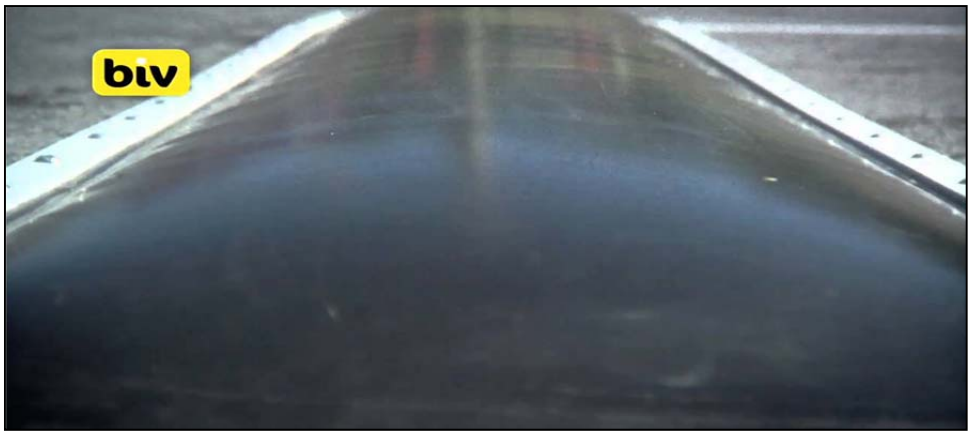


Figure 13. Badennova artificial road roughness.

This behavior is due to a non-newtonian fluid, which is the filling material of the bumping and which manifests itself differently than the water. By crossing artificial bumps at low speed, the liquid, due to its viscosity, turns into a lubricant and manages to fill its gaps between the particles, at high speed, due to increased friction force, this fluid rapidly increases viscosity. The fluid is biodegradable, non-toxic, non-contaminating. Also, this

material proved to be particularly resistant to adverse meteorological conditions, vandalism and increased transport flow, said *Andaltec*, a leader in the plastics industry. Most importantly, the fluid inside can be chosen depending on the imposed circulation speed and is not dependent on the ambient temperature.

The swedish company *Edeva* has developed an artificial road roughness with an unusual construction (figure 14): it is not elevated from the surface of the road, on the contrary, it „*sinks*" into it, but only when necessary.

In order not to pay for overtaking the speed of repairing the car suspension and not to withstand the unpleasant strokes, it is necessary to reduce the speed of passing over the artificial abrasion. In addition, artificial distortions cause problems to responsible drivers, because they have to pass them practically with the speed of the turtle. Besides, when driving over artificial bumps, the car is thrown up strongly, which can lead to an accident.

The *Swedes* decided to come up with something more modern and more efficient than a „*primitive*" denigration on the road. Their construction, called *Actibump*, has in itself an active artificial deformation, which in normal position is at the same level as the road. However, if an excessive speed car is approaching, an artificial deflection is immediately formed on the road.

The idea of *Actibump* is pretty simple. The system recognizes the speed violation due to sensors installed in the road surface, near the artificial bump. If the vehicle speed exceeds the established limit, the metal plate, which is at the same level as the road, enters the asphalt to a depth of six centimeters. As a result, the wheels roll into an artificial pit, the suspension of the car receives a significant blow, and the careless driver estimates the cost of future repair. *Edeva* experts confirm that their system is safer than regular artificial deflections and does not oblige all drivers to brake and then accelerate again, consuming extra fuel.

Obviously, local leaders have appreciated the novelty: according to *Edeva*, the speed overtaking in these areas has fallen by 95%.

Figure 14. Actibump artificial bump.

Plates and tactile indicators for the blind. The touch pad is itself a tactile indicator for the blind, designed to indicate the direction of movement or the presence of obstacles.

It is known that a person without visual deficiencies receives over 90% of environmental information by visual means. Contemporary man must move slightly into space. These skills have been developing since childhood and require no special talent. Moving through the city with his parents, the child gradually becomes familiar with his streets. In time, he himself can find the way to school, then to the institute and to work. However, what is easy for a healthy person presents a lot of difficulties for those with poor vision. As a rule, such people are very limited in their capacities, it is very difficult to orient themselves in space. Many of them are forced to rely on those around or on a guiding dog.

Visual perception of blind people is replaced by hearing and tactile perception, ie, what a blind person can not see, try to hear or feel by touching the legs, arms by a special touch stick for the blind. To memorize the route to the desired object, a blind person carefully explores the path, looking for the smallest features that can become reference points. Among these features there are: holes, curbs, stairs, characteristic noises, or even smells in certain places, anything that could become signs of tactile or auditory signs.

To facilitate the movement and orientation in space of the blind, tactile terrestrial signs in the form of plates, strips, stripes, markers, cones are provided. These tactile signs indicate the direction of movement of the blind person or warn him about the presence of danger, obstacle, modification of road character – stairs, roadway etc. The tactile indicators must be mounted on objects with heavy traffic both inside and outside buildings: hospitals, educational institutions, cultural and administrative institutions, parks, stadiums, etc. In order to convey the information, the tactile indicators have a certain type of raised surface: stripes and cone shaped reefs. The name, geometric shapes and destination of each tactile indicator are described below.

1. *Prohibited crossing*. Square board with cones placed in the shape of a chessboard (figure 15, a). Warns about the presence of an obstacle or dangerous areas. These can be pillars, supports, curbs, fencing, walls, carports near the road etc.
2. *Pass carefully*. Square plate with cones placed in a linear order (figure 15, b). Warns about the areas, some have to move carefully. These can be stairs, separate steps, ramps, escalators etc.
3. *Passing the road*. Square plate with lines (strips) (figure 15, c). Warns about the exit on the pedestrian crossing or the roadside part of the road.
4. *Take the turn to the passage*. Square plate with diagonal lines (figure 15, d). Warns about the presence of the passage, located on one side of the pedestrian trail.
5. *Move forward*. Three parallel lines along the path (figure 15, e). Communicates the possibility of moving forward to the right or left of the indicator.
6. *Bifurcation*. Square plate with cones placed in linear order (figure 15, f). Communicates about turning or ramification of the road.

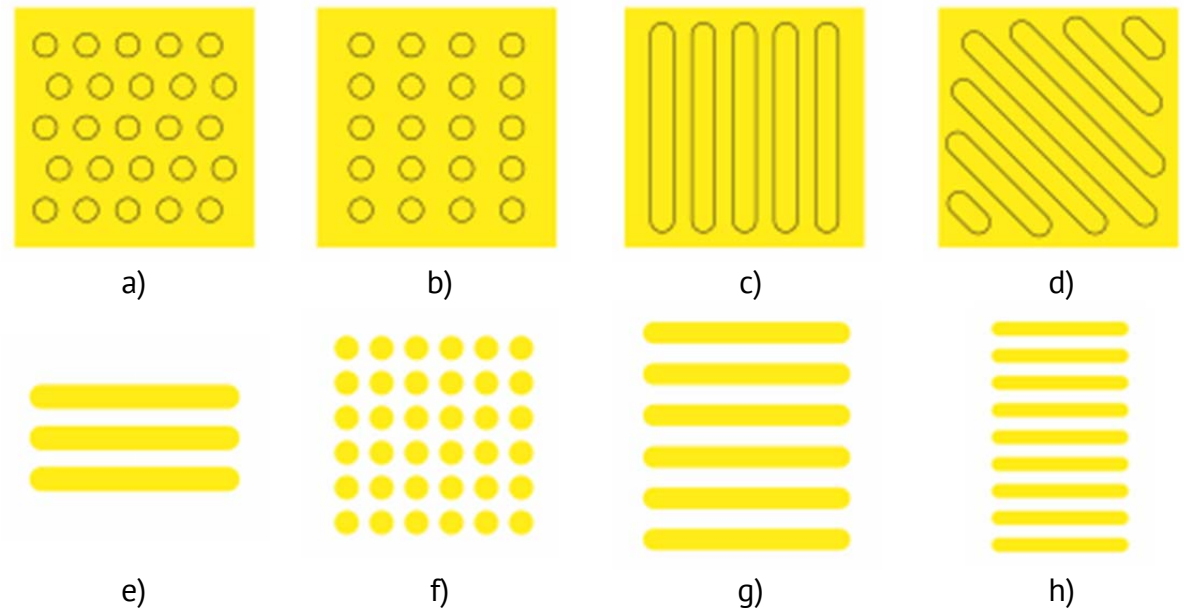


Figure 15. Touchscreens.

7. *Significant object*. Six parallel lines along the object (figure 15, g). Communicates the presence of a significant object along the way, for example, a flag installed at the station of the road vehicles.
8. *Obtaining services, information*. Nine parallel lines along the object (figure 15, h). Communicates about the possibility of obtaining the consultation or information: the counter of the house, the information office, the registry, the store, and the location of the mnemonic information system.

As can be seen, the presence of tactile plates in public places greatly facilitates the life of the blind person: to reach the bathroom, to move on stairs, to enter the building, to cross the street etc.

Conclusions. One of the priorities of any state on road safety is to prevent road accidents involving pedestrians. Pedestrian passages are currently the most acute problem. Half of all road accidents in large cities are pedestrian buffers, one third of which takes place on pedestrian crossings. Of course, in most of these accidents the drivers are accused, but not everything is so simple – often those who cross the road behave irresponsibly. In addition, there are also deficiencies on the part of those who are obliged to ensure the safety of the citizens of the country – the officials, responsible for the maintenance and the operation of the roads.

The majority of pedestrians, who cross the road to its designated location, feel fully safe, but in practice this is different. The number of „*zebra*" road accidents increases each year, and many of them end up bad for pedestrians. The solution for this acute problem requires goodwill of all road users. Neither should the Government stand apart. Developing and upgrading the system of road signs and markers, increasing the number of pedestrian crossings and safety islands, limiting the speed of driving, etc. can not fully solve this problem without applying innovative technologies. Implementing intelligent highway solutions to pedestrian crossings would increase traffic safety, resulting in the salvation of human lives, but it should not be forgotten that responsibility falls on the shoulders of all road users.

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