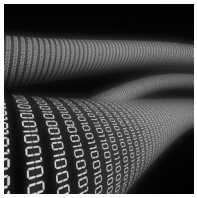

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Traffic calming as one of the methods of traffic management as illustrated by the "Dutch Town" project in Pulawy

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ABSTRACT

Traffic calming by means of physical measures enables to perform traffic management functions in those areas of cities and towns where ITS are absent. Traffic calming is also effective in improving road safety, which is of outmost importance considering that each year in Poland around 5 thousand people get killed in road crashes and excessive vehicle speed remains the main contributory factor. Thanks to a reduced incidence of speeding and undesired transit movements that are kerbed by physical measures, traffic calming makes it possible to manage vehicle speeds and accessibility of the road network over a whole area as well as to prevent crashes and mitigate other transport-related inconvenience.
A comprehensive traffic calming area was built in Puławy. It covers a section of the regional road No 824 and the adjacent residential area of Włostowice. The design drawings of the so called Dutch Town Project performed by EKKOM Sp. z o.o. included the adjustment of several best practices of road safety engineering used in the Netherlands to the Polish conditions and this solution is unprecedented in many aspects. The redesign of the streets combined with traffic calming has helped to solve a number local problems and at the same time a showcase of traffic calming for training purpose was created.

KEYWORDS: traffic calming, road safety, Dutch Town Project, Puławy

1. Traffic calming and traffic management

In cities, traffic speed has a significant influence on such parameters of the communication system as travel time, traffic capacity, exhaust emission, noise emission and other traffic annoyances. But in most cases, the relation between speed and traffic safety is the most important factor. Vehicle speed is the main hazard in traffic, as the higher the speed, the harder it is to avoid an accident and the more serious the injuries. In Poland, excessive speed is the cause of approx. 30% of fatal accidents, i.e. every year more than 1,500 people die because of excessive speed. Exceeding the speed limit is common, but roads crossing small towns, where 94% of drivers exceed the speed limits, are the worst. Despite a speed limit of 50 km/h, the average speed of vehicles driving through small towns is 76 km/h. In large cities, 85% of drivers drive too fast. This is a fatal threat, especially to pedestrians and bikers, that do not have the protection of a vehicle's body. This is why Poland is at the top of this disgraceful statistic: approx. 34% of all casualties killed in accidents are pedestrians, which is the highest in the EU, while bikers amount to approx. 11% [1].

Meanwhile, by appropriately shaping the road and its surrounding, we can effectively prevent accidents and other annoyances by making it physically impossible to exceed the speed limit and eliminating unwanted transit traffic. International studies have proven, that lowering the average speed by 5% results in a 10% decrease in the overall number of accidents, and a 20% decrease in fatal accidents [1]. Apart from this, the environmental benefits are also considerable: lower speed causes less noise and reduced emissions of harmful gases, while a decreased number of accidents serves to limit the spills of harmful substances from crashed cars and roadside structures.

Traffic calming means shaping the road environment using planning and engineering in a way, which allows for achieving a comprehensive improvement in traffic safety, reduced transportation-related nuisances and improved public spaces in developed areas. The main aim of traffic calming is to provide safety through enforcing desirable driver behaviours and preventing the undesirable ones. One can quote numerous definitions of traffic calming, but its aim and range remain the same: it is a comprehensive activity striving to create safe conditions for moving through developed areas, putting the needs of pedestrians and bikers above others.

Traffic calming allows for managing speed and road availability in given area, as well as for preventing accidents and decreasing other traffic-related nuisances by physically hindering the ability to exceed speed limits and limiting unwanted transit traffic. Thus, through traffic calming, traffic management functions become available in places, where intelligent transportation systems are not implemented. Traffic calming is, by principle, introduced in large urban areas and uses physical means of road engineering and traffic organisation in order to improve safety, environmental friendliness and spatial order, as well as the value of surrounding areas. The activities include road network management, speed management and spatial development.

The most important aim of traffic calming is to ensure safe vehicle speed and speed limit enforcement, using appropriate road geometry, street decoration and traffic organising elements, that physically prevent the drivers from exceeding the speed limit and other dangerous manoeuvres, such as overtaking. This is accompanied by constructing new pavements and bike lanes to ensure safe pedestrian and bike traffic. Providing safe parking spaces and proper formation of parking areas are also very important. Traffic calming is most beneficial for pedestrians and cyclists, as they are the most endangered in accidents, but all traffic participants benefit from improved safety.

2. Comprehensive implementation of traffic calming in Puławy – "Dutch Town" project

The city of Puławy is located in the central-eastern Poland, at the western edge of lubelskie voivodeship, and is the northernmost tip of the famous "tourist triangle": Kazimierz Dolny – Nałęczów – Puławy. There is one national road passing through the city (no. 12). In this situation, the foundation of the road system in the city and in the whole "tourist triangle" region consists of regional roads. Regional road no. 824 has especially dense traffic, as it is the only access road to Kazimierz Dolny from the northern and western regions of Poland, as well as the access road to Nałęczów.

The project is located in the Włostowice district, in the southern part of Puławy. The project is limited by the following streets: Kazimierska, Włostowicka, Skowieszyńska, Powstańców Listopadowych, Piękna and Kilińskiego. The Kazimierska and Włostowicka streets are both parts of regional road no. 824, which serves as the southern exit from the city and connects Puławy with, among others, Kazimierz Dolny, one of the most attractive tourist spots in the region. The main premises of this project can be characterised as follows:

- maintaining the current transit function of regional road no. 824, while adding speed limiting features;
- verifying the accessibility and speed limits of this road and enforcing them through engineering means;
- discouraging transit traffic to pass through the housing estate (by leaving the regional road and driving into the estate).

Puławy adopted a traffic calming scheme modelled after Holland, which has a long-standing and very rich tradition in traffic management and engineering, especially in traffic calming. The Dutch solutions required some adjustment to Polish realities and local conditions, i.e. available road width, existing road surface, water removal systems, underground reinforcement, as well as Polish legal regulations.

The project includes a road section of approx. 9.2 km: a section of regional road no. 824 in Puławy (exit towards Kazimierz Dolny) of approx. 2.7 km and the streets of the neighbouring Włostowice housing estate. The estimated length of streets in the housing estate included in the project is approx. 6.5 km. Short sections of the streets within the estate were rebuilt, and local traffic calming elements were installed. The transformation of the traffic network of Włostowice estate, as well as adopted traffic calming elements, are described below.

3. Traffic calming – implementation methodology

In order to achieve the desired safety levels for both drivers and pedestrians/cyclists, traffic calming strives to ensure safe vehicle speeds in built-up areas and to limit the number of vehicles using local roads and passing through city centres. Traffic calming is an extensive programme, which includes:

- functional hierarchization of roads and streets;
- managing the accessibility of roads and streets;
- speed zoning;
- traffic calming means;

Functional hierarchization of roads and streets;

The introduction of functional divisions and hierarchization of roads and streets means dividing the roads according to their three basic functions:

- Transit function. The main purpose of transit roads is to provide long-distance international, national and regional connections, as well as connections between cities.
- Distributing function. The main purpose of distributing roads is to provide connections between different districts and areas in cities and towns, access to housing estates, city centres and commercial areas, as well as connections to transit roads.
- Access function. The main purpose of access road is the internal communication in districts and areas of cities and towns: housing estates, city centres and commercial areas, as well as the connection to distributing roads.

Created a hierarchical road network which meets these criteria requires having a road network in each one of these categories. In Poland, the network of transit roads is currently under construction, but creating such a system is already possible in a part of a city or a subregion. The district of Włostowice in Puławy has largely succeeded at this task. The primary communication system consists of Kazimierska and Włostowicka streets (parts of regional road no. 824), as well as Skowieszyńska and Kaznowskiego (regular streets). This is the primary road network, on which most passenger cars, trucks and buses move. Regional road no. 824 has the heaviest traffic, mostly due to transit traffic. Other streets that support this communication system are mainly local. These streets have a dense network of intersections and are mainly local, i.e. they begin and end within the same housing estate. The road system of Włostowice after traffic calming is implemented is shown below.

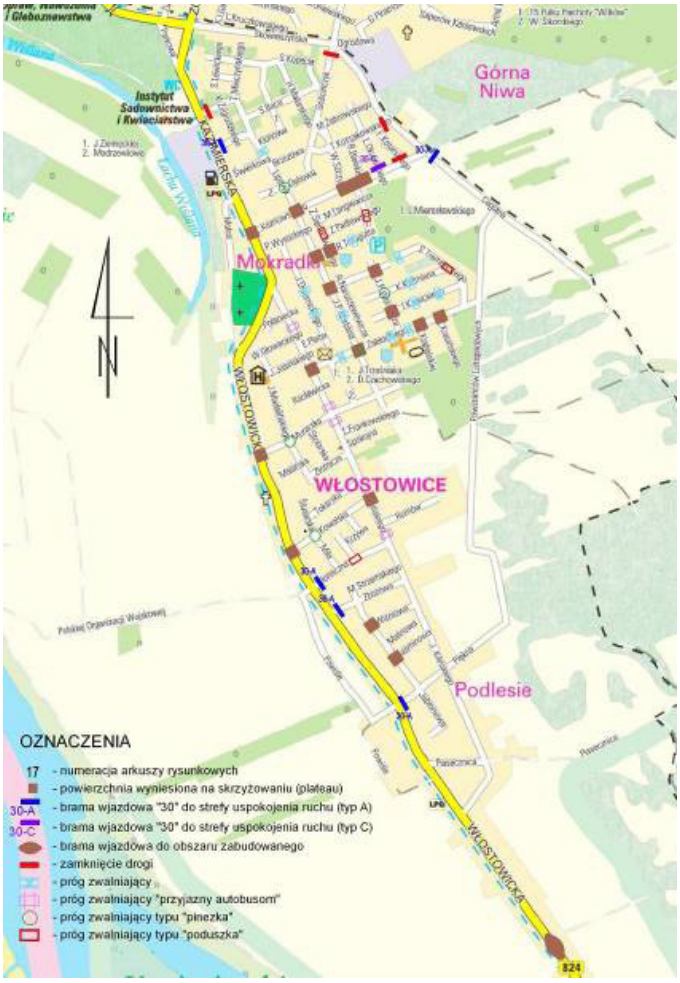

Fig. 1. Road network in Włostowice – traffic-calmed zone
Source: [own work]

Managing the accessibility of roads and streets

Managing the accessibility includes setting and controlling access points such as intersections, exit roads from houses, parking areas, commercial buildings, public buildings, etc. Speaking in general, the more accessible a road is, the higher the risk of accidents.

In the traffic calming project for Puławy, Kazimierska, Włostowicka, Kaznowskiego and Skowieszyńska streets are distributing roads. They had a dense network of connections to local streets, that served as access roads. Therefore, in order to ensure proper functionality and trafficability of these distributing roads, as well as provide safe conditions for driving at 50 km/h, limiting the number of intersections of distributing and access roads became necessary. This is also needed to ensure transit traffic along the distributing road and deter the drivers from passing thorough the housing estate. Such action, however, is always controversial among locals and municipal authorities, as it interferes with local traditions and driving habits.

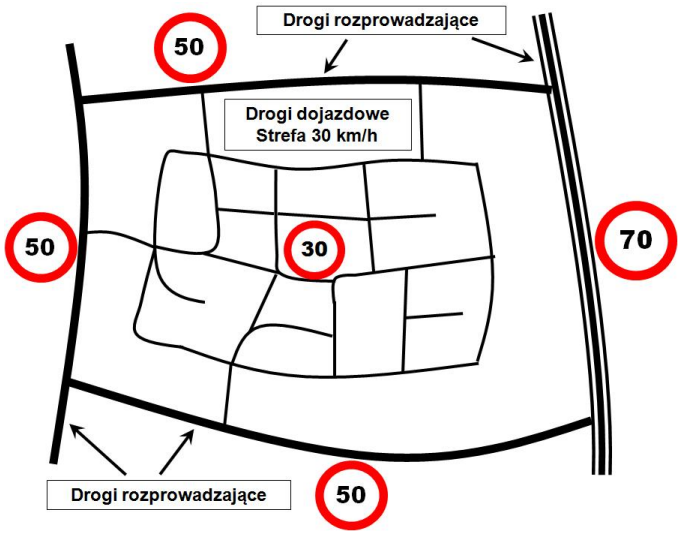

Fig. 1. Functional diagram of street network in traffic-calmed zone
Source: [own work]

The hierarchization scheme for the road network, with access limitations and speed limit zoning, are presented in the figure below.

Speed zoning

The main purpose of speed zoning is to ensure conformity between the function, technical parameters and purpose of given road, and the speed limit enforced on it. A functional diagram of a street network includes speed zones appropriate for given road's function. Speed limits are enforced by shaping the surface geometry, introducing traffic-calming elements and designing street decorations appropriate for given speed limit.

The "Dutch Town" project includes 50 km/h and 30km/h zones, according to the functional division into distributing and access roads. The 50 km/h zone is selective, i.e. the speed limit applies to selected streets. These are the fundamental roads serving a distributing function: Kazimierska and Włostowicka streets (regional road no. 824), as well as Skowieszyńska and Kaznowskiego, that create a frame for access roads.

The 30 km/h zones are local: this speed limit applies to certain areas of the district. There can be lower speed limits within these areas, e.g. in the residential area within the project. The 30 zones are contained in the 50 zone on the eastern side of Włostowicka and Kazimierska streets and are divided by Kaznowskiego street. One was created in the northern part, in the Kazimierska - Kaznowskiego – Skowieszyńska quarter. The second, southern 30 km/h zone is framed by Włostowicka and Kaznowskiego streets. Below you can see the functional hierarchization diagram of the road network with speed zoning.

Traffic calming means

Ensuring safe speeds means using traffic calming measures, i.e. the solutions of road engineering that physically prevent excessive speeds. They are thus used to enforce speed limits. They include both road surface shaping and traffic organising elements. The road environment is a very important factor in influencing the behaviour of drivers. This applies mainly to driving speed. Drivers choose their driving speed chiefly based on the surface they see before them and traffic organisation. That's correctly shaped surfaces, road cross-sections and traffic organisation, as well as the placement of traffic-calming measures may help in effective management of driving speed: keep vehicle speed at safe levels and prevent the vehicle from exceeding the speed limits by enforcing legal speed limits for given road/street.

Such division was imposed by the functions of regional and local roads, traffic intensity, available road widths, various constructions and types of road surfaces. The traffic on the regional road had to be slowed down (distributing function) while maintaining full trafficability (transit elements), as it would cause a traffic paralysis in this part of city, especially on weekends, when recreational traffic towards Kazimierz Dolny is especially intensive. The needs in Włostowice estate were diametrically different. Traffic had to be considerably slowed down in narrow local streets, among dense detached houses, and safety of the unprotected pedestrians, especially children walking to the schools located at the estate, Had to be ensured.

Typical linear traffic-calming elements were installed along the 2.7-km section of the distributing road (a section of regional road no. 824, Kazimierska and Włostowicka streets):

- a raised, paved, variable-width central lane (passable);
- entry gates to the town (built-up area) from the south;
- raised instersections;
- intersections with separate left-turn lanes;
- a bike lane connected to the bike lane network in the city;
- new bus stop bays.

Moreover, surface and water removal system were modernised.

What's more, local traffic calming was implemented in an area of 6.5 km, in access roads located in Włostowice estate. Local solutions were used, mainly situated in intersections or long straight sections, were excessive speeds are a risk:

- full and partial closing of selected streets;
- sinusoidal speed bumps;
- "thumbtack" speed bumps;
- "cushion" speed bumps;
- bus-friendly speed bumps;

- raised instersections;
- entry gates to "30 zones".

The "Dutch Town" traffic-calming project in Puławy proves that traffic management by implementing comprehensive traffic calming areas is possible in Poland and, considering the threat of excessive speed – very much needed as well. This project has to be treated as an experiment, which will check the effectiveness and stability of these solutions. One of the most important features of this project is its comprehensive approach to traffic calming. The solutions implement the concept of functional hierarchization of roads, they are interconnected and complementary. They form a logical whole, both in the Włostowice estate and regional road no. 824. The new infrastructure successfully blends into the landscape of this part of city and is a positive aesthetic element. The entry into Puławy from Kazimierz Dolny will surely be a showpiece.

We should hope that, just like in Western Europe, as the main road network in Poland keeps developing, a methodical and comprehensive implementation of traffic calming measures will become popular among road administration officials. In order to facilitate this task, the "Rules for traffic calming using physical technical measures" were created and trainings are being held.

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