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REVIEW AND COMPARISON OF TRAFFIC CALMING SOLUTIONS: MEXICO CITY AND KATOWICE

Abstract. The article addresses solutions implemented in two cities, namely, Mexico City and Katowice, with the aim of improving road traffic safety. Despite the distance of more than 10,000 km separating the two cities, a comparison revealed many similar solutions having been implemented in both of them. This comparative case study is complemented with a collation of statistics pertaining to accidents, fatalities and injured persons as reported in the period 2012-2015.

Keywords: traffic calming; traffic engineering; road safety

1. INTRODUCTION

Poland is currently still ranked above other countries in respect of poor road traffic safety. The group of unprotected traffic participants, namely pedestrians, typically accounts for one third of all road traffic accident fatalities. In Silesia Province, 257 persons were killed in road

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traffic accidents in 2016, including as many as 99 pedestrians. The World Health Organization positions Mexico in seventh place for fatal traffic accidents in the world, with Mexico City being the country's most significant contributor to the number of incidents in this respect.

In both places (Katowice and Mexico City), one can observe a significant increase in the number of solutions implemented over recent years in terms of traffic calming. The primary objectives of these efforts include reducing vehicle speed and separating transit from commuter traffic, thus minimizing the negative effects of road traffic, which translate into specific numbers of fatal accidents and injuries. Speed exerts a major impact on traffic safety, as it affects both the number of accidents and their severity [10]. Drivers maintaining a safe running speed in a manner that matches road conditions (visibility, curves, intersections, pedestrian crossings and public transport stops, pavement roughness and levelness, road surroundings, weather conditions), as well as traffic conditions (traffic intensity, other vehicles' running speed, overtaking conditions, presence of pedestrians at road shoulders), is a factor that favours safe traffic. As running speed rises, the degree of road traffic accident severity increases, as does the hazard for traffic participants, whereas the possibilities of avoiding collisions dwindle [1, 2, 13, 14, 19, 20].

In this article, activities aimed at traffic calming in Mexico City and Katowice are compared. In the next section, a collation of road traffic safety statistics is presented. Both the aspects analysed confirm that the situation has been improving.

2. TRAFFIC CALMING: A COMPARATIVE CASE STUDY ON MEXICO CITY AND KATOWICE

Car traffic in city centres is an issue that provokes much controversy. All activities aimed at the reorganization of city centre traffic are usually widely approved by one or several groups of inhabitants, while raising objections in others. It is for this very reason that undertaking bold efforts, such as establishing traffic calming zones or limiting access to selected streets at the heart of the city, has often been extremely difficult. There are also cases when one can place such problems as urban traffic flow or safety of pedestrians and cyclists into one basket, and the private interests of persons commuting into city centres by car (and using a car to move around within the centre) into another, as the latter are often unaware of the benefits that urban traffic calming or switching to alternative means of transport may bring.

One may refer to numerous premises and conditions behind the implementation of the traffic calming concept, such as the following (among others [15, 16, 17, 18]):

- Arterial roads being overflown with cars
- Policies that favour commuting by car
- Pollution and noise increases due to car traffic
- Degradation of urban space due to car traffic and parking
- Declining road traffic safety and growing threats for pedestrians and cyclists due to excessive running speed

The authors of the article have decided to address the traffic calming problem using examples from two significantly different cities, namely, Mexico City and Katowice. The population of Mexico City exceeds 8.9 million people [12], while Katowice is inhabited by around 0.3 million people (the total population of Silesia Province is less than 4.6 million) [7].

Examples of the solutions applied in Mexico City are illustrated in Fig. 1.

a) Speed radars

b) Video recorders

c) Breathalyser operations

d) Speed bumps

e) Secure lanes for truck freight

f) Night operations

Fig. 1. Comparison of traffic calming solutions implemented in Mexico City (source: based on [8])

The most fundamental solutions include speed radars (58 pieces distributed all over the city) and speed bumps. Various analyses imply that speed bumps are the most efficient traffic calming tool. The most commonly used bumps are 3.6 x 6.6 m in length. Under Polish conditions, speed bumps reduce the traffic stream speed by 25% compared with the obligatory speed limit [12]. Frequent sobriety checking is also an efficient means to improve safety (Fig. 1c). Inhabitants may already be familiar with speed limit regulations, speed radars and speed

bumps, but the latest implementation for road safety in Mexico is the use of video recording devices (Fig. 1b). These video recorders (currently 40 devices installed all over the city) feature cameras installed at strategic points of the city, designed to record the moments when the driver does not respect traffic lights, forbidden turns, pedestrian crossings or bike tracks. These cameras also record situations when drivers are not wearing their seatbelts properly or when they are using mobile phones while driving. Whenever the camera detects one of these infringements, the system automatically sends a ticket to the car owner.

In order to ensure safety for people, as well as for truck freight, a plan for night routes has been established for freight circulation, each of which is monitored. The Mexican authorities have defined specific routes for cargo vehicles, as well as driving hours, on access-controlled high-speed roads with a maximum speed of 60 km/h.

The least common traffic calming solution used in Mexico City is referred to as *night operations* (Fig. 1f), which have also contributed to a significant reduction in the number of night incidents. Every night, on average, there are 73 such operations conducted all over the city, whose main goal is to educate drivers by placing a line of police patrol vehicles at the front of a vehicle traffic column, circulated at a regulated speed on controlled access roads. This has led to a reduction of 13% in the number of car accidents during the night shift (from 22:00 to 06:00).

The driving speed limitations introduced in Mexico City range between 80 and 10 km/h, depending on the specific location or the speed limit zone. These speed limitations have been collated in Table 1. In most streets in the city, one can drive a car at 50 km/h, with the exception of several trunk roads (these being subject to intense speed monitoring), where the permissible speed is 80 km/h (Fig. 2)

Tab. 1

Comparison of speed limit zones introduced in Mexico City

Speed limit	Sector
10 km/h	In car parks and on pedestrian paths in which access to vehicles is allowed
20 km/h	In scholar zones, hospitals, nursing homes, shelters and homes
30 km/h	In quiet transit zones
40 km/h	On secondary roads including the sides of controlled access roads
50 km/h	Circulation on primary roads
80 km/h	Central lanes of controlled access roads

(source: based on [8])

Being the capital city of Silesia Province, Katowice features a very dense road network. On account of the necessity to improve pedestrian safety and the need for a modal split transformation in favour of alternative solutions to the use of passenger cars, a special traffic calming zone corresponding to the city centre was introduced in 2015 (Fig. 3). Entrance to the zone, referred to as "Tempo 30", has been distinctively marked with vertical and horizontal signs (Fig. 4a-b). The most popular traffic calming facilities used there are the speed humps (speed cushions) installed at the zone borders, forcing drivers to reduce their speed considerably. The chosen locations where these measures have been used are situated near to centres of culture, public offices or schools (Fig. 5a). Other characteristic elements of the solutions implemented there are raised pedestrian crossings, as well as road pavements, which have been redeveloped using paving stone (Fig. 5b). One can also encounter entire intersections, which have been raised and stone paved (Fig. 5c). Due to uneven pavement

surface, drivers reduce their driving speed in order to avoid damaging their car. (Intentional) chicanes represent another traffic calming measure applied in Katowice. In the case shown in Fig. 4f, the chicanes were developed by alternating locations of parking spaces (on the left-hand and the right-hand side, alternately), forcing drivers to dynamically change the driving track and reduce speed.

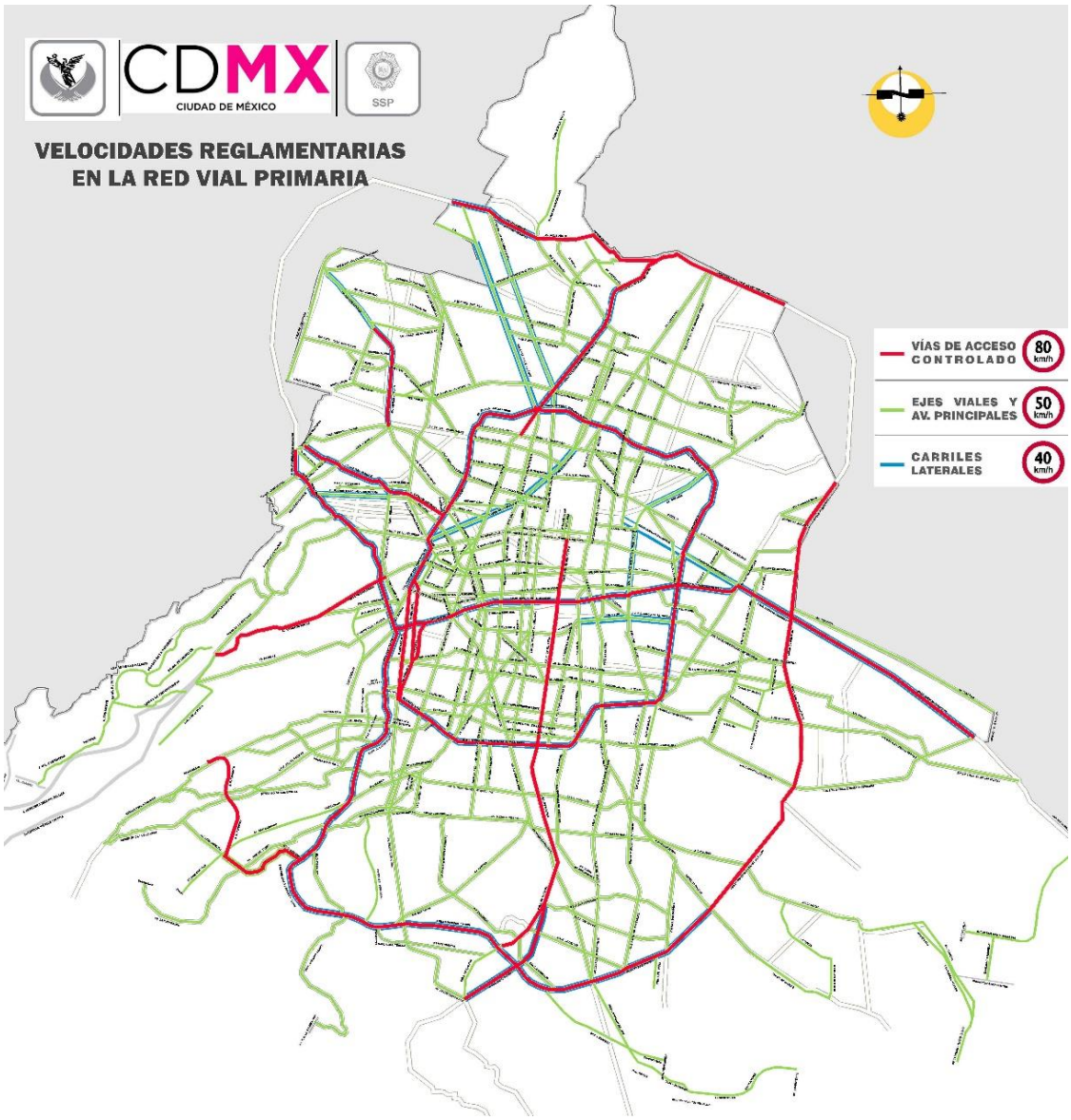

Fig. 2. Map of Mexico City streets subject to speed limitations (excluding zones with speed limits below 40 km/h) [8]

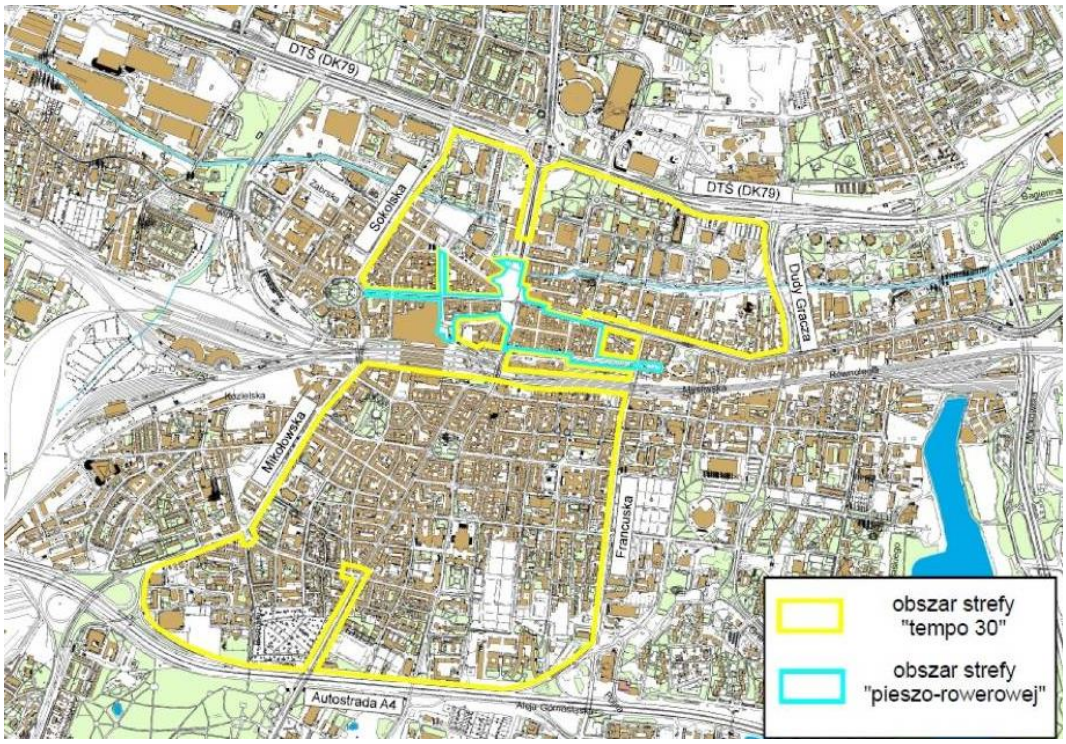

Fig. 3. Map of Katowice with the "Tempo 30" traffic calming zone marked (yellow colour delimits the "Tempo 30" zone, while blue marks the "walking and biking only" zone) (source: [6])

a) Szkolna Street, Katowice

b) Jagiellońska Street, Katowice

Fig. 4. Marking at the beginning of the "Tempo 30" zone in Katowice (source: own research)

a) Traffic calming elements known as speed cushions (Andrzeja Street, Katowice)

b) Marking at the beginning of the "Tempo 30" zone (Jagiellońska Street, Katowice)

c) Raised intersection (Sienkiewicza and Powstańców Streets, Katowice)

d) Alternating parking spaces (Plebiscytowa Street, Katowice)

Fig. 5. Comparison of selected traffic calming solutions implemented in Katowice (source: own research)

Within the traffic calming zone of downtown Katowice, a walking and biking only zone has also been sectioned off (marked in blue on Fig. 3), which covers streets where automotive vehicles are forbidden to enter (including Mariacka, Staromiejska, 3-go Maja, Stawowa and Rynek Streets). That said, this zone has not eliminated another element threatening pedestrians, namely, trams running on lines that intersect to a considerable extent in the main square area (Rynek). In order to reduce accident hazard exposure, an innovative solution has been applied, i.e., long colour-changing lamps embedded in the pavement. As a default, they emit green light when there is no tram approaching, but, when one is incoming, their illumination changes to red. Owing to this solution, even when paying no special attention to the surrounding, pedestrians will realize the tram's proximity. An example illustrating the concept is provided in Fig. 6.

Fig. 6. Lights warning pedestrians of an incoming tram (source: own research)

3. REVIEW OF ACCIDENT STATISTICS FOR 2012-2015

A review of the Mexico City accident statistics (Table 2) for the last five years implies that the situation has improved significantly. The number of traffic accidents and fatalities has decreased considerably in recent years in Mexico City. From 2011 to 2015, the number of persons injured dropped by nearly 49%, whereas the number of fatalities dropped by more than 38%. A considerable quantitative drop, i.e., by 48%, was also observed in traffic accident figures. The decrease in the number of accidents involving pedestrians is yet another positive fact worth mentioning. This is due to the safety and public awareness programmes that have recently been implemented in different parts of the capital city.

Tab. 2

Mexico City accident statistics

Year	Fatal traffic accidents (deaths)	Non-fatal traffic accidents (injured)	Persons killed in traffic accidents	Persons injured in traffic accidents	Accidents involving pedestrians
2012	315	4,221	343	5,673	1,248
2013	342	3,548	370	4,801	1,112
2014	291	2,822	312	3,799	1,017
2015	200	2,147	210	2,899	748

(Source: own research based on [3])

With regard to Katowice, the number of fatalities dropped by 40% in the corresponding period (Table 3). However, the decrease in the number of traffic accidents (by only as much as 7%) and persons injured (8%) does not imply any major improvement in this respect. Therefore, the implementation of the "Tempo 30" zone in 2015 should be regarded as well grounded, since a more significant improvement was achieved in a similar period, compared to the entire province, which translated into nearly 19% fewer accidents and 20% fewer injured persons (Table 4).

Tab. 3

Katowice accident statistics

Year	Total traffic accidents (deaths and injured)	Persons killed in traffic accidents	Persons injured in traffic accidents	Pedestrians killed in traffic accidents	Pedestrians injured in traffic accidents
2012	301	20	338	10	113
2013	303	21	352	14	94
2014	276	14	322	9	158
2015	280	12	311	7	98

(Source: own research based on [5, 10])

Tab. 4

Silesia Province accident statistics

Year	Total traffic accidents (deaths and injured)	Persons killed in traffic accidents	Persons injured in traffic accidents
2012	4,675	336	5707
2013	4,529	267	5506
2014	4,360	249	5324
2015	3,792	255	4584

(Source: own research based on [4])

The initial period when the "Tempo 30" zone was functioning triggered an improvement in road traffic safety across the zone area. The total number of accidents in the zone dropped by 41% in 2016 (compared to 2014, i.e., before the zone concept implementation), while the number of injured persons declined by 32%. A similar comparison for accidents involving pedestrians and cyclists is provided in Fig. 7. One can also notice a clear improvement in safety within the zone in this respect.

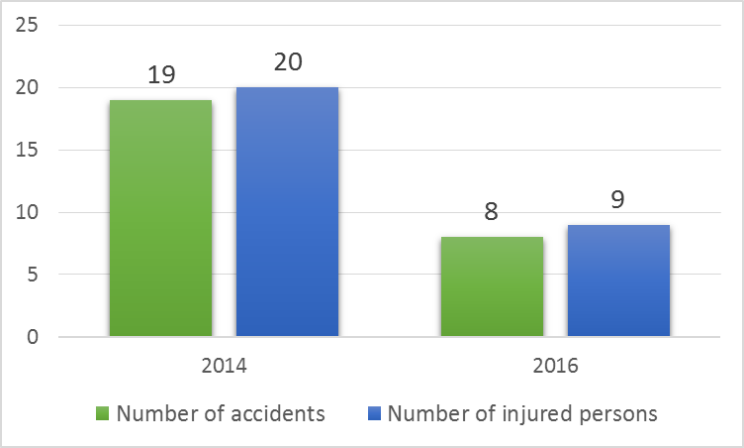

Fig. 7. Comparison of statistics for accidents involving pedestrians and cyclists that took place in the "Tempo 30" zone in Katowice in 2014 and 2016
(source: own research based on [4])

4. CONCLUSIONS

The traffic calming methods discussed in the article are mainly related to infrastructural solutions. In both cities analysed in the paper, physical obstacles forcing drivers to reduce driving speed and speed limit zones were deployed. As confirmed by the analysis, both the number of accidents and the number of persons killed and injured declined (the analysis covered the period 2012-2015), although the improvement thus achieved was more evident in Mexico City. The fact that should be emphasized is that fatality figures increased in 2013 in both cities. Other speed limiting methods, which also deserve to be highlighted, include the night operations introduced in Mexico City, since this solution prevents driving faster than the speed limit set by police vehicles. This method has not been applied in Poland.

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