

## **SAFETY INCREASE ON CROSSROADS IN RZESZÓW BY INSTALLATION OF LIGHT SIGNALING WITH AUTOMATIC ROADS TRAFFIC MEASUREMENTS**

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### **Abstract**

*The article presents solutions of crossroads which make it possible to eradicate dangerous places at selected crossroads in Rzeszów. The solution consists in redeveloping traffic lights signalizations and installations of self-exited system with automatic traffic measurements. The idea of safety increase comes down to the implementation of accommodated traffic lights for all road traffic users. This installation is adapted to the road traffic changes by altering the time of green signals for vehicular traffic and omitting the green lights for pedestrians if not necessary. The traffic control is realized on the basis of current registration of traffic intensity with a video detecting system (for vehicular traffic) and push-button (for pedestrian traffic). At the crossroads there are separate roadways to turn left. The traffic control system is divided into four elementary traffic phases, the sequence of which is dependent on the analyzed traffic situation. The safety increase was also accomplished by improvements of friction grip. It was a result of a special layer of SMA asphalt (4 centimeter thickness) application. Additionally, there were safety barriers built, which preclude car parking in the neighborhood of crossroads. These solutions increased visibility at crossroads. The goal of the rebuilding was to decrease the number of road accidents in vehicular and pedestrian traffic. The bettering of the traffic flow and the improvement of safety at Rzeszów crossroads were achieved by the crossroads rebuilding and traffic control system application at the following crossroads: Lubelska – Maczka – Wyzwolenia streets and Targowa – Piłsudskiego – Głowackiego Streets. The investment project assumed over 50% decrease of the quantity of road accidents.*

**Keywords:** *transport, road rebuilding, safety increase, crossroads*

## 1. Introduction

The economic growth of provincial centres in Poland entails the necessity to build and modernize a network of roads, and to organize traffic. Investments of this kind affect the safety improvement of road users in pedestrian and vehicular traffic. Road investments require that detailed research be conducted. [1-2, 4].

A prominent cultural, educational and economic centre in south-eastern Poland, Rzeszów is also the intersection of major communication routes. The crossroads discussed herein are important communications hubs of local and extra-regional character. The repair and modernization work in the field of the described crossroads in Rzeszów has a considerable impact not only on the vehicle traffic flow but also on the development of the city. Rebuilding crossroads in Rzeszów necessitates substantial financial outlays. However, it was possible to commence the investments thanks to the acquisition of funds from the second edition of the *Road Dangerous Places Eradication Scheme*.

## 2. Subject of road investment

The subject of investment was the installation of induced traffic light signalizations based on automatic traffic measurement at the crossroads of Lubelska – Maczka – Wyzwolenia Streets (Fig. 1) and the rebuilding of the intersection of Lubelska – Staromiejska – Trembeckiego Streets (Fig. 2) together with the installation of accommodated traffic lights using a video detecting system and coordinating the crossroads with the adjacent one at Lubelska – Maczka - Wyzwolenia Streets. The investment was implemented by Miejski Zarząd Dróg i Zieleni (City Committee for Roads and Green Areas) in Rzeszów [6, 8].

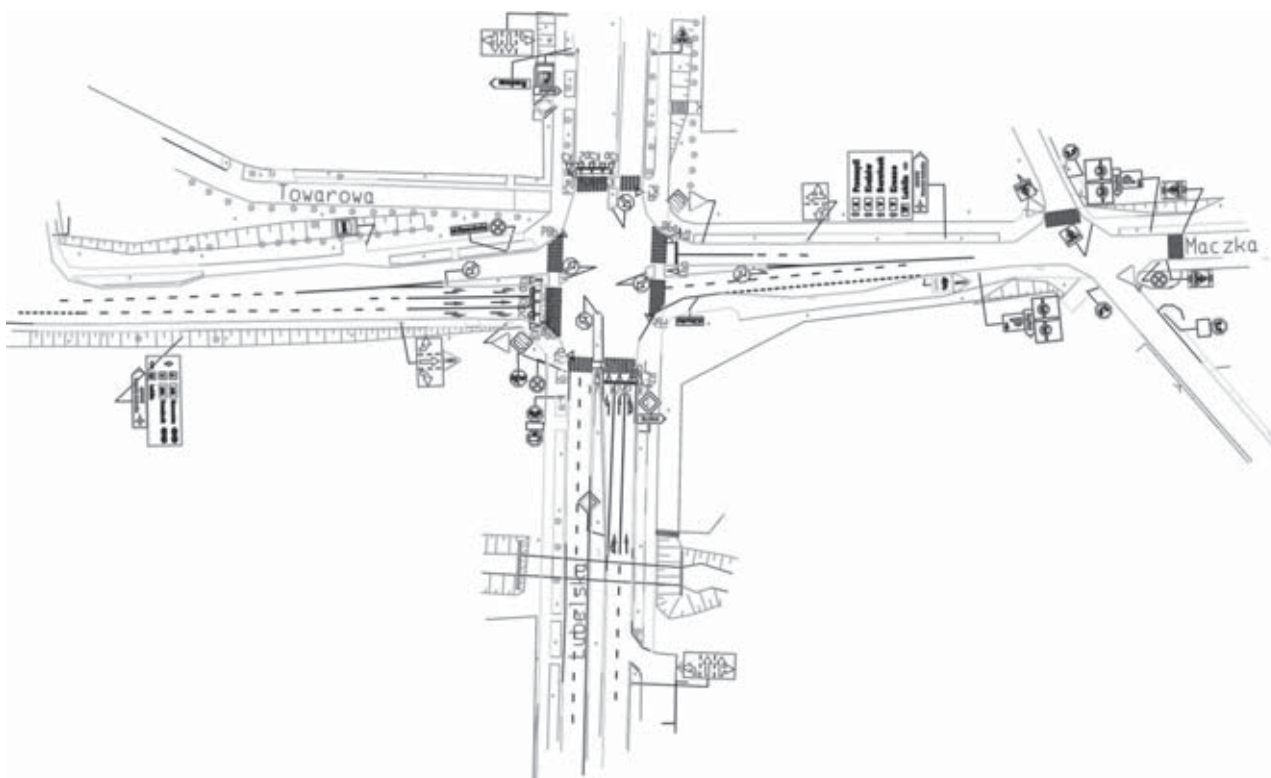
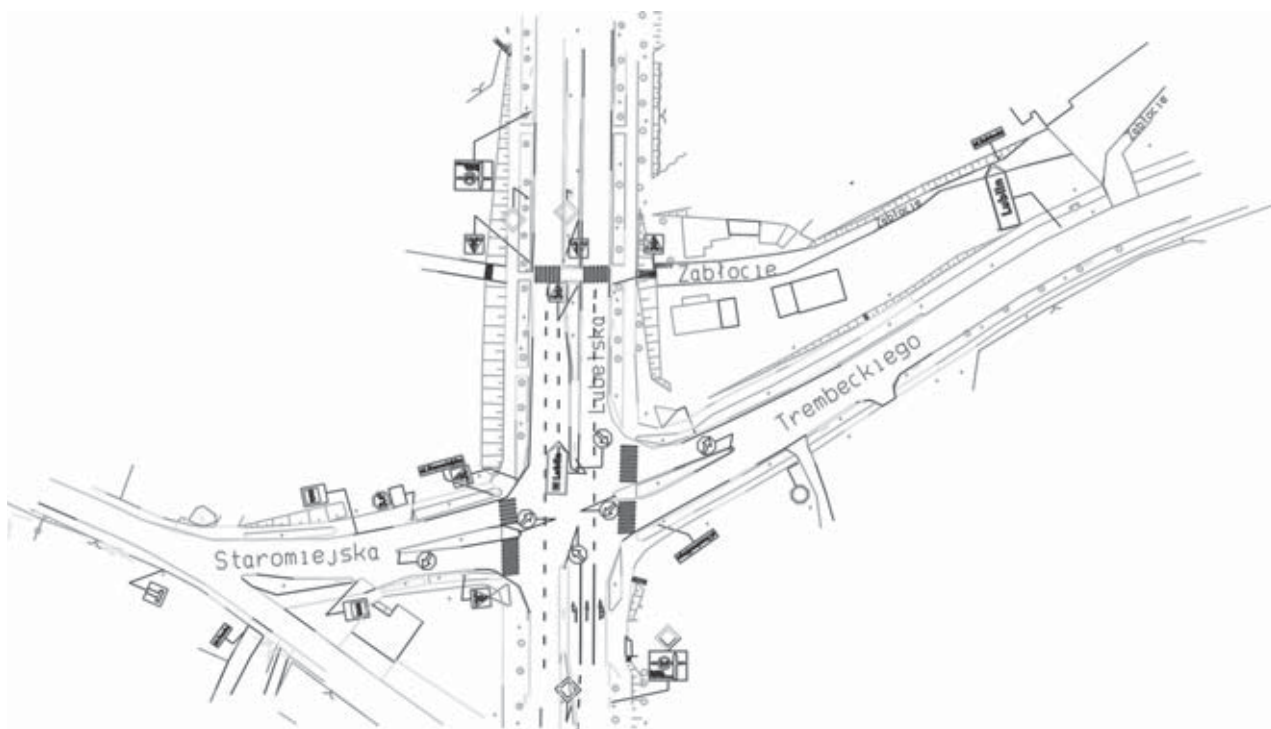


Fig. 1. A visual representation of the crossroads of Lubelska – Maczka – Wyzwolenia Streets prior to the rebuilding [3]

The crossroads of Lubelska – Maczka – Wyzwolenia Streets is a four-way intersection. The main direction is Lubelska Street (three traffic lanes); Maczka Street (two traffic lanes) and Wyzwolenia Street (three traffic lanes) are roads without right of way. Before the modernization

there was a two-phase traffic light signalization installed. In the vicinity of the crossroads designated are four pedestrian crossings, which were 4 meters in width before the rebuilding.



*Fig. 2. A visual representation of the crossroads of Lubelska – Staromiejska – Trembeckiego Streets prior to the rebuilding [2]*

The crossroads of Lubelska – Trembeckiego – Staromiejska Streets is one with routed traffic. Lubelska street is a main road no. 19 with right of way, Staromiejska and Trembeckiego streets are local roads. Whereas Lubelska Street has two roadways, each divided into two traffic lanes, both Staromiejska and Trembeckiego are merely one-roadway streets with a single traffic lane running in each direction. In the neighborhood of the crossroads both streets are fully routed, with an asphaltic concrete surface. While Lubelska Street has priority, Staromiejska and Trembeckiego Streets are roads without right of way. There are two left turn lanes on the approaches of Lubelska Street.

### **3. Investment implementation**

Rebuilding the crossroads of Lubelska – Maczka – Wyzwolenia Streets and the intersection of Lubelska – Staromiejska – Trembeckiego Streets, following the assumptions of *Road Dangerous Places Eradication Scheme*, is aimed at increasing the safety of road users. In both of the discussed cases, raising the safety level pertains to vehicular as well as pedestrian traffic. In accordance with the assumptions, based on which the reconstruction projects were qualified for the *Scheme*, it was of the utmost importance to separate pedestrian traffic from vehicular by means of using traffic safety devices in the form of barriers that deter pedestrians from crossing the street and to preclude car parking in the neighborhood of the crossroads. Additionally, the separation of vehicular traffic was implemented through the installation of the Sp-06/2 energy-absorbing barriers on the dividing lanes, which eliminated the possibility of one vehicle colliding into another on the opposite traffic lane. Another major step was to increase the roughness of the surface on both the intersection itself and the individual approaches by applying a removable four-centimetre SMA asphalt layer, which significantly affects safety level increase, especially in a period when, due to adverse atmospheric conditions, surface grip is diminished.



*Fig. 3. A photograph of the crossroads of Lubelska – Maczka – Wyzwolenia Streets after the rebuilding*



*Fig. 4. A photograph of the crossroads of Lubelska – Staromiejska – Trembeckiego Streets after the rebuilding*

#### **4. Conclusions**

For the intersection of Lubelska – Maczka – Wyzwolenia Streets, accommodated traffic lights have been designed for all road users in such a way as to meet the current acyclic traffic needs. Acyclic traffic results from the intensification of the departures of the city public transport buses and

their returns to the depot located at Trembeckiego Street, which coincides with the inhabitants commuting to work or returning home from work. The adaptation consists in altering the time of green signals for vehicular traffic and omitting the green lights for pedestrians if not necessary. The traffic control is realized on the basis of current registration of traffic intensity with a video detecting system (for vehicular traffic) and push-button (for pedestrian traffic). The traffic control system is divided into four elementary traffic phases, the sequence of which is dependent on the analyzed traffic situation. Additionally, in order to improve traffic capacity, left turns have been allowed at the intersection with the greatest volume of heavy vehicle traffic, i.e. on the route of road no. 9 running from Wyzwolenia Street into Lubelska Street.

For the crossroads of Lubelska – Staromiejska – Trembeckiego Streets, left turn lane elongation from 25 m to 70 m on the main direction and the allocation of left turns on the approaches without way of right have been implemented in an effort to prevent vehicle collisions. A traffic light signalization has been designed sectioning off left turn lanes controlled by direction-indicating traffic lights. For the ‘straight’ direction and the right turn, general signalizations and arrows that permit turning right have been installed with the use of signalizations above all traffic lanes. Moreover, the building of the right turn and a bus bay also influenced the improvement of safety and the crossroads traffic capacity. Before the modernization, the bus pulled up directly on the roadway. The traffic light signalization has been designed as an acyclic accommodated system using video detection and coordinated with the adjacent intersection of Lubelska – Maczka – Wyzwolenia Streets on the main direction of Lubelska Street. The organization of traffic and signalization was devised upon introducing changes in the crossroads geometry.

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