

4. Transport and the economy: The relationship between transport and the economy.

## **RESEARCH OF THE TIME FOR VEHICLES TO OVERCOME DISTANCES BETWEEN TRAFFIC SIGNALS ON CITY HIGHWAYS**

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The problem of managing conflicting flows of road users is and remains relevant all over the world, and does not have a completely acceptable solution even when considering only the traffic flows. The main way to organize traffic at the busiest intersections is to use traffic signals. At the busiest street intersections, the primary way to manage traffic is traffic signal control. And if the traffic signals are close together, then it is a good practice to coordinate them to organize the smoothest flow of vehicles in one or both directions, i.e. introduce the so-called «Green Wave». It should be noted that traffic signal coordination methods date back to the 1960s, but even today they are not perfect, as they do not take into account all the features of vehicle traffic, even in the simplest case of traditional coordination on one street or its section.

It is obvious, that unlike the vehicles in the major street platoon that can arrive at the upstream coordinated intersection at the assumed speed, additional vehicles from minor streets usually have to start moving from zero speed and need some time to attain the progression speed. Determining the conditions required for proper interaction of the vehicles from minor and major streets in a coordinated signal system is an essential issue, the solution of which will facilitate the design of a coordinated timing plan for arterial and improve coordination efficiency.

The general idea of vehicle movement on a coordinated highway is to move at a constant speed, which is well illustrated by the space-time diagram [1]. The main task of the coordination plan is only to create unimpeded conditions for the movement of

the coordinated area. However, the task of ensuring the unimpeded movement of a platoon of vehicles when there are additional vehicles from secondary directions queuing at each following intersection of a coordinated highway is much more difficult than in the absence of these vehicles. To solve this problem, it is necessary to turn on the permissive signal for the main traffic directions in advance to allow additional vehicles to accelerate from zero speed to traffic speed. The time to ensure that the green signal is turned on early (lead time) should increase the cycle time by shifting the start of the green signal assigned based on the displacement [2].

It is an obvious fact that the more additional vehicles queued up in front of the intersection stop-line, the longer it takes for them to accelerate to the speed of the moving vehicle. This paper will consider a possible procedure for obtaining the value of the average constant acceleration of a vehicle on coordinated distances of highways, which is the purpose of the study.

To gain information about vehicle traffic on the main sections, a field method of research was used. For the field survey, a recording video recorder located in the car was used to work continuously while the vehicle was moving. Processing of the footage consists in fixing the time of movement of the vehicle that first stands in front of the stop-line (our or nearby, if it can be followed) and starts its movement on the green traffic signal and continuously passes the next stop-line.

As part of this work, the objects of experimental research were the main sections of the city of Kharkiv. At present, the results of 29 measurements of the time required to overcome the sections between traffic signals have been obtained. Based on this data and the length of the relevant distances, the speed of the vehicle with which it overcomes it is determined, as well as the corresponding acceleration value when it accelerates to this speed (table 1).

**Table 1 – Results of field observations**

Length of the distance, m	Time to overcome the distance by vehicle, s	Vehicle speed on the distance, m/s	Vehicle acceleration, m/s <sup>2</sup>
340,85	32,08	10,63	0,33
340,85	27	12,62	0,47

340,85	29	11,75	0,41
340,85	32	10,65	0,33
340,85	34	10,03	0,29
286,00	27,02	10,58	0,39
442,09	29	15,24	0,53
442,09	30	14,74	0,49
407,04	29,34	13,87	0,47
407,04	31	13,13	0,42
407,04	28,34	14,36	0,51
407,04	26	15,66	0,60
407,04	50	8,14	0,16
442,09	44	10,05	0,23
340,85	31,43	10,84	0,35
340,85	30	11,36	0,38
344,89	25,14	13,72	0,55
344,89	23,45	14,71	0,63
344,89	24,18	14,26	0,59
344,89	22,48	15,34	0,68
344,89	23,37	14,76	0,63
344,89	22,89	15,07	0,66
344,89	22,53	15,31	0,68
159,27	11,16	14,27	1,28
159,27	12,38	12,87	1,04
159,27	14,23	11,19	0,79
159,27	10,57	15,07	1,43
159,27	11,25	14,16	1,26
159,27	12,61	12,63	1,00

The data also revealed that the highest values of vehicle acceleration are typical for distances up to 200 m. There are various explanations for this fact: firstly, the driving style, the time of measurement (for example, driving to work in the morning), and the power of the vehicle; secondly, when driving on quite long distances, it is possible to observe a decrease or stabilization of driving speed by drivers.

As part of this work, a statistical estimation of vehicle acceleration on distance between TS was also conducted. As a result, it was established that the acceleration of vehicles during acceleration from a standstill is distributed according to a log-normal distribution law with the parameters: mean 0,61 and standard deviation 0,101. The obtained results do not contradict the existing world research in the field of traffic dynamics on urban highways [3].

### **Referenses**

1. TRB, 2015. Signal Timing Manual. 2nd ed. Washington: The National Academies Press. <https://doi.org/10.17226/22097>.
2. TRB, 2000. Highway Capacity Manual, Washington: National Research Council.
3. Long, G., 2000. Acceleration Characteristics of Starting Vehicles. Transportation Research Record 1737(1), 58-70. DOI: <https://doi.org/10.3141/1737-08>.

## **THE ROLE OF LOGISTICS IN THE MODERN SUPPLY CHAIN**

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Logistics plays a crucial role in the supply chain for several reasons. Firstly, logistics is responsible for the transportation of goods from one point to another. This involves the selection of the most appropriate mode of transportation, such as air, sea, or land, and the management of the transportation process. Logistics also ensures that goods are transported efficiently and cost-effectively, which helps to reduce the overall cost of the supply chain.

Secondly, logistics is responsible for the storage and management of inventory. This involves the selection of appropriate storage facilities, such as warehouses and distribution centers, and the management of inventory levels. Logistics also ensures that inventory is stored and managed efficiently and cost-effectively, which helps to reduce the overall cost of the supply chain.

Thirdly, logistics is responsible for the management of information flows. This involves the collection, analysis, and dissemination of information about the movement