

To the conclusion it must be said that at the same time future engineers must obtain standard technical competencies and global competence. Success in developing global competence among engineering students will require a deviation from the current practices of providing a few add-on international courses or experiences. Improving global outcomes in engineering will require a total integration of global competence across the curriculum.

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#### ANALYTICAL DEFINITION RADIUS OF TURN VEHICLES FOR PERFORMANCE CALCULATIONS DURATION OF A CYCLE TRAFFIC LIGHT REGULATIONS

*Definition dependences for a finding range of change radius of turn vehicles allows to determine in the settlement way a range of change of their speeds and a stream of saturation that allows to approach from new positions to calculation of duration of a cycle traffic light regulations.*

At realization of maneuver of turn on a crossroads, first, exists not uniform value of radius turn of the automobile, and a range of values radius of turn vehicle. Second, to each value radius of turn automobile there corresponds the certain value of

allowable settlement speed. Thirdly, this value of allowable settlement speed determines a stream of saturation on a crossroads and time of travel by a vehicle of a crossroads, and from here and parameters of work traffic light object.

Having determined radius of turn it is possible to define a way of movement, speed, and also time of crossing of a crossroads the automobile. Accordingly knowing these parameters, we shall define a stream of saturation of a transport stream. Proceeding from this, we receive calculation of techniques determining physical processes at realization of turn by the automobile. The urgency of given article consists in it.

In the parameter used in calculations of duration of a cycle of regulation traffic light, the stream of saturation is. Concrete values of a stream of saturation are determined by natural inspections and analytically.

In well-known work [1] it is underlined, that « ... the technique of experimental definition of a stream of saturation  $M_{ni}$  demands essential expenses of time. ... For the right – and turning left the streams moving on specially allocated strips, the stream of saturation is determined depending on radius of turn R: – for single-row movement  $M_{ni} = 1800 / (1 + 1,525 / R)$  (3.5); for two-row movements  $M_{ni} = 3000 / (1 + 1,525 / R)$  (3.6). The radius of turn can be determined under the plan of the crossroads drawn in scale. At two-row movement in the formula (3.6) substitute average value ».

From the resulted text not clear: 1) how average value of radius is determined; 2) what physical sense of “average radius”. In our opinion, on a crossroads it is necessary to define radius of turn separately for each strip of each direction of movement.

In work [3] connection between a stream of saturation of rotary directions is established depending on radius of turn on the basis of experimental data here again already there are other dependences. For example, «At radius of turn less than 40 meters, are offered by the author the formula for calculation of a stream of saturation:



$M_{\text{turn}} = 770 + 60R - 0,74R^2$ , (4) where  $R$  – radius of turn, m» [3] on a basis average the statistical data « the Settlement curve for definition of a stream of saturation for turning left maneuvers also is developed depending on radius of turn and time of an allowing step» [4].

The purpose of work – to find analytical dependences for definition of a range of change of radius of turn of automatic telephone exchange.

On rice 1 the settlement circuit of a crossroads for definition of radius of turn of automatic telephone exchange is resulted. From all possible {probable} turns of the automatic telephone exchanges which are carried out on this crossroads, on fig. 1 one left turn from the main road to minor road is shown only. Besides letter designations of parameters of the crossroads necessary for the decision of a task in view are put: to determine analytical dependences of radius of turn of the automobile at its movement from a point 1 to a point 2 (fig. 1).

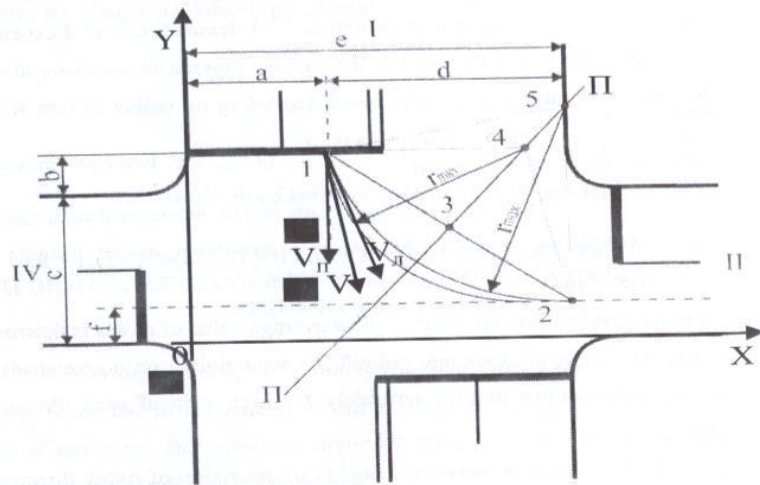


Fig. 1 Settlement circuit for definition of radius of turn of automatic telephone exchange

The equation of the straight line which is taking place through these set точки 1 and 2, looks like [2]:

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1} \quad (1)$$

Parameters of particularly set two points 1 and 2:

a point 1:  $y_1 = b + \text{with}$ ;  $x_1 = \text{and}$ ; a point 2:  $y_2 = f$ ;  $x_2 = \text{and} + d$ .

After transformations, according to (1), the common equation of a straight line 1-2, the beginning and which end are formed by points 1 and 2, looks like:

$$yd + x(b + c - f) - d(b + c) - a(b + c - f) = 0. \quad (2)$$

The equation (2) we shall transform to a kind:  $at = kx + b$ . Then:

$$y = x \frac{b + c - f}{d} + b + c + \frac{a(b + c - f)}{d} \quad (3)$$

The angular factor  $k$  is equal  $\text{tg } \delta$  where  $\delta$  – the corner between a positive direction of an axis  $x$  and a straight line 1-2, and looks like:

$$k = \frac{b + c - f}{d} \quad (4)$$

The direct line  $\tilde{A}-\tilde{A}$  which is taking place perpendicularly to a straight line 1-2 through its middle in a point 3, will be a geometrical place of all circles which are taking place through points 1 and 2. Coordinates of a point 3 accordingly have expressions:  $x_3 = a + 0,5d$ ;  $y_3 = 0,5(b + \text{with} - f) + f$ .

Direct line  $\tilde{A}-\tilde{A}$  has angular factor.  $k_{\Pi} = \frac{1}{k} = \frac{d}{b + c - f}$

The equation of the straight line which is taking place through the set point 3, looks like [1]:

$$y - y_3 = k_{\Pi}(x - x_3). \quad (5)$$

After transformations (5) in view of expressions for  $x_3$ ,  $y_3$  and sanctions of the received expression separately be relative  $x$  and at we have:

$$x = a + 0,5d + \frac{[y - 0,5(b + c + f)](b + c - f)}{d}; \quad (6)$$

$$y = x \frac{d}{b + c - f} + 0,5(b + c + f) + \frac{d(a + 0,5d)}{b + c - f} \quad (7)$$

The analysis on the drawing of vectors of speeds  $V_{\Pi}$ ,  $V$ ,  $V_{\lambda}$  in a point 1, results in a conclusion, that the minimal and maximal values of radiuses  $R_{\text{min}}$  and  $R_{\text{max}}$ .

satisfying safety of traffic, are determined by positions of points 4 and 5 on direct line  $\bar{A} - \bar{A}$ .

Using the equation (6) and substituting in it for a point 4 value at = with + b, we shall receive analytical expression for definition of value x which has the following kind:

$$x = a + 0,5d + \frac{0,5(b+c-f)^2}{d}$$

From the drawing it is visible that  $R_{\min}$  it is equaled to length of a piece 1 - 4,  $R_{\min} = x - a$  and. From here:

$$R_{\min} = 0,5d + \frac{0,5(b+c-f)^2}{d} \quad (8)$$

Using the equation (7) and substituting in it for a point 5 value  $x = a + d$ , we shall receive expression for definition of value y which has the following kind:

$$y = 0,5(b+c+f) + \frac{0,5d^2}{b+c-f} \quad (9)$$

From the drawing it is visible, that  $R_{\max}$  it is equaled to length of a piece 5 - 2,  $R_{\max} = y - f$ . From here:

$$R_{\max} = 0,5(b+c-f) + \frac{0,5d^2}{b+c-f} \quad (10)$$

It is similarly possible to receive separately analytical dependences by definition of a range of change of radius of turn for all resolved by the circuit of the organization of traffic of directions.

Because there is a huge quantity {amount} of the crossroads distinguished by a lay-out and parameters analytical dependences by definition of a range of change of radius of turn for all resolved by the circuit of the organization of traffic of directions also will be various.

#### Conclusions

1. In job analytical dependences for definition of the minimal and maximal value of radius of turn of the automobile, i.e. a range of its change for the first time are determined.

2. Knowing a range of change of radius of turn of the automobile, structure of a transport stream and radius of turn of automobiles from this structure, incorporated structurally, it is possible to determine an opportunity of realization of maneuver by each automobile from this structure.

3. Knowing a range of change of radius of turn of the automobile, it is possible to determine as much as possible allowable speed of realization of turn.

4. On the certain value of as much as possible allowable speed of realization of turn and known length of a trajectory of the automobile it is possible to determine time of a fare of a crossroads one automobile, and from here it is possible to calculate a stream of saturation.

5. Calculation of streams of saturation on resolved by the circuit of the organization of traffic to directions allows to determine duration of a cycle светофорного regulations and to optimize to the robot светофорного object since the physical sense of calculations made by it will be clear to the designer.

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