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MINISTRY OF REGIONAL DEVELOPMENT
AND PUBLIC WORKS
MINISTRY OF INTERIOR
MINISTRY OF TRANSPORT AND COMMUNICATIONS

Regulation No... on traffic management with road traffic lights

Chapter One
GENERAL PROVISIONS

Article 1. The Regulation sets out the conditions, procedure, location, method of installation and requirements for the traffic lights when organising traffic on roads open to public use, the types of traffic lights used to regulate the movement of vehicles and pedestrians, as well as the duration of intermediate times, transition intervals, signal clearances and cycles of traffic light systems.

Article 2. When establishing a temporary traffic organisation for vehicles and pedestrians with light traffic signals, the type and method of installation of traffic lights shall be determined in accordance with the requirements of the Regulation referred to in Article (3)(4) of the Road Traffic Law (RTL). The duration of intermediate times, transition intervals, signal clearances and the cycle of portable traffic light systems shall be determined in accordance with the methodology set out in Annex 1.

Article 3. (1) A traffic light is a device consisting of sections providing light signals to control the movement of its users, in accordance with Article (12) of the RTL.

(2) A traffic light shall consist of one or more separate traffic light sections, each emitting light of a certain colour and direction according to Annex 2.

Article 4. (1) Traffic lights shall be installed:

1. in the populated areas, according to a design for traffic organisation and safety in the settlements, developed on the basis of the Master Plan on Road Traffic Organisation;

2. outside the boundaries of settlements, in accordance with a design for the organisation and safety of traffic outside the inhabited areas;

(2) The designs referred to in paragraph (1) shall be elaborated, agreed and approved under the terms and procedure laid down in the Regulation referred to in Article (3)(3) of the RTL.

Article 5. (1) A light signal to regulate the movement of road vehicles and pedestrians is a colour light emitted by a light field of certain shape and dimensions.

(2) Light signals shall be emitted by traffic lights.

(3) Each light signal has a certain meaning which is mandatory for the traffic participants for

whom it is intended.

Article 6. The control of traffic via light signals is the sequential passage through a given road location (regulated zone) of vehicles and pedestrians moving in different directions. A regulated zone may be a junction, a pedestrian walkway, a cycle path, entrance/exit of/from a building or property, narrow sections, road lanes, railway crossings.

Article 7. Intersections, pedestrian walkways and cycle paths, the entrances and exits of/from buildings or property where traffic is controlled by light signals shall have functioning exterior lighting.

Chapter Two.
LIGHT SIGNALS FOR TRAFFIC CONTROL

Article 8. The following types of light signals shall be used to regulate the movement of road vehicles (RTVs):

1. Non-flashing light:

(a) Green colour – signifying 'The passing is allowed'. Where this signal is displayed at an intersection, drivers who will not be able to leave the intersection until the next signal change shall not enter the intersection;

(b) Red colour – signifying 'The passing is prohibited'. Drivers of road vehicles must not cross the 'stop line' or, if there is no stop line, must not cross the line on which the traffic light is placed. Where the traffic light is placed in the middle of the intersection, drivers shall not enter the intersection or pedestrian walkway;

(c) Yellow colour – signifying 'Attention, stop!'. This does not only apply to those drivers who, at the time of displaying this signal, having previously been allowed to pass, are so close to the traffic light that they cannot stop without creating a traffic hazard. Upon display of this signal at an intersection, drivers entering or within the intersection are required to clear the intersection.

(d) Yellow colour emitted simultaneously with red unblinking light – signifying 'Passing is prohibited'. This signal warns the drivers that a green signal is about to be displayed;

2. Flashing light:

(a) One or two red lights flashing consecutively, one of which is switched on when the other is switched off, signifying 'Passing is prohibited'.

(b) Flashing yellow light – signifying 'Attention!'. Drivers and pedestrians can continue their movement, but must be careful and cautious.

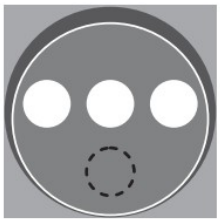
(c) A flashing green light warns of the approach of the end of the clearance signal.

Article 9. To prohibit and permit road transport vehicles (RTVs) to enter a road lane

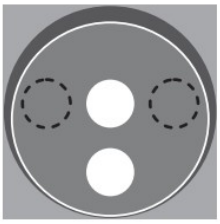
demarcated by road markings, non-flashing light signals shall be used, located above the road lane, which are of colour and meaning as follows:

1. Green in colour – signifying ‘Traffic on the lane is allowed’;
2. Red in colour – signifying ‘Traffic on the lane is prohibited’.

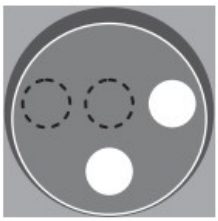
Article 10. To regulate the movement of vehicles of the scheduled public passenger transport services (SPPTS), signals with non-flashing lights of moon-white colour shall be used. Traffic light signals, depending on the interposition of the lights switched on, signify the following:



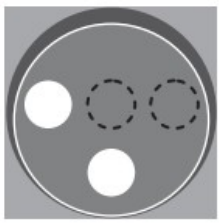
1. All upper lights on and the lower light off – entry into the intersection is prohibited;



2. A lower light and the upper light above it switched on – traffic is allowed to go straight;



3. A lower light and the upper light at its right switched on – traffic is allowed to go to the right;



4. A lower light and the upper light at its lefr switched on – traffic is allowed to go to the left.

Article 11. Non-flashing light signals shall be used to regulate pedestrian movements. Light signals shall signify the following:

1. Red colour light – signifying ‘Passing is prohibited’. Pedestrians who are in the carriageway when this signal is displayed must clear it;

2. Green colour light – signifying ‘Passing is allowed’.

Chapter Three.
TYPES OF TRAFFIC LIGHTS AND LIGHT SIGNALS EMITTED BY THEM

Section I.
Types of traffic lights

Article 12. Depending on their intended use, road traffic lights, are as follows:

1. Intended to regulate the traffic of RTVs on intersections, pedestrian walkways, narrowed sections and other sections of the road;

2. Intended to allow and prohibit RTVs to enter a traffic lane;

3. Intended to prohibit RTVs from crossing a railway crossing;

4. Intended to regulate the movement of vehicles of the SPPTS;

5. Intended to regulate the traffic of cyclists;

6. Intended to regulate the traffic of pedestrians;

7. Intended to regulate the traffic of pedestrians and cyclists simultaneously.

Section II.
Traffic lights intended to regulate the movement of RTVs at intersections, pedestrian walkways, narrowed and other sections of the road

Article 13. (1) Traffic lights with three sections (three-sectioned traffic lights) shall be used to regulate the movement of RTVs at intersections, pedestrian walkways, narrowed and other sections of the road. They provide signals with red, yellow and green non-flashing lights or one yellow flashing light.

(2) Traffic light sections are arranged vertically as per Annex 3, letter (a) as follows:

1. the section that emits red light shall be on the top;

2. the section that emits yellow light shall be in the middle;

3. the section that emits green light shall be at the bottom.

(3) Where a traffic light is located in a tunnel, above the carriageway or in another location with a restricted height gauge, a horizontal arrangement of sections in accordance with Annex 3, letter (b) shall be permitted as follows:

1. the section that emits red light shall be on the left;

2. the section that emits yellow light shall be in the middle;

3. the section that emits green light shall be on the right.

(4) The light fields of road traffic lights shall take the form of a circle having a diameter of 100, 200 or 300 mm.

(5) The green light-emitting field may take the form of an arrow(s) inscribed in a circle with a black background. In this case, the contours of the same arrow(s) shall be applied to the illuminated fields with red and yellow light according to Annex No 4.

(6) In the case of illuminated fields formed in accordance with paragraph (5), the action of the light signals shall apply only to the direction(s) indicated by the arrow(s).

(7) The arrow corresponding to the direction to go straight shall be pointing upwards.

Article 14. (1) A three-sectioned road traffic light with illuminated fields in the shape of a circle without arrows shall be used when the passage of RTVs in different directions from the entry to the regulated zone are regulated by signals which are emitted simultaneously.

(2) A three-sectioned road traffic light with inscribed arrows in the illuminated fields shall be used at intersections only when the passage of RTVs in different directions from the entry to the regulated zone are regulated by light signals which are not emitted simultaneously.

(3) In the cases referred to in paragraph (2), the mounting of a traffic light with a green illuminated field in the shape of a circle without arrow(s) at that entrance to the intersection shall not be permitted.

(4) Three-sectioned traffic lights according to Article (13)(1) shall be used to regulate the movement of non-rail vehicles from SPPTS, of pedestrians and of bicyclists, in cases where no appropriate specialized traffic lights for the specified categories of road users are installed.

Article 15. (1) The sequence of light signals from the three-sectioned traffic light shall be as follows:

1. red light;

2. red and yellow light emitted simultaneously;

3. green light;

4. yellow light;

5. red light.

(2) The sequence of light signals from a three-sectioned traffic light under Article (35)(1), point (6) to regulate the movement of RTVs may follow the below successive order:

1. be dark;

2. emit light signal in yellow colour;

3. emit light signal in red colour;

4. be dark.

Article 16. (1) On a three-sectioned traffic light with illuminated fields in the shape of a circle without arrows, an additional section with an illuminated field with a green light in the form of an arrow on a black background, directed to the right, inscribed in a circle according to Annex No 5, may be installed.

(2) The additional section shall be placed to the right of the three-sectioned traffic light at the level of the illuminated circle-shaped field providing green light signals.

(3)The inclusion of the light signal of the additional section referred to in paragraph (1) means that drivers may continue their movement only in the direction indicated by the arrow, provided that they pass through the intersection the movement of road vehicles and pedestrians for which there is also a clearance signal.

(4) The additional section may emit a signal with a green light only by the simultaneous red and/or yellow light emittance from the three-sectioned traffic light next to which it is placed.

Article 17. At junctions controlled via traffic lights, the right-turn clearance signal for parallel traffic flows shall start at the same time or later compared to the clearance signal for the pedestrians, according to the geometry of the crossroad.

Article 18. For flashing yellow light a traffic light with one section shall be used. The illuminated field of the section shall have the shape of a circle without arrows with a diameter of 200 or 300 mm.

Article 19. All light fields of traffic lights used to regulate the movement of RTVs shall have a diameter of 300 mm in cases where they are placed on a road outside the boundaries of settlements and, in settlements, when they are situated above the traffic lane or are at the exit of an intersection and are intended to duplicate the emitted light signal at the entrance of the intersection.

Article 20. (1) The light-emitting fields of traffic lights used to regulate the movement of RTVs may be 200 mm in diameter when placed on a road or street in settlements on the side of the traffic lane.

(2) To ensure better visibility, the light-emitting field of the red signal section may have a diameter of 300 mm.

Article 21. (1) A three-section traffic light with illuminated fields in the shape of a circle with a diameter of 100 mm on a black background on which a bicycle symbol is painted in red, yellow and green in accordance with Annex No 6 shall be used to regulate the traffic on cycling infrastructure.

(2) In the case of more than one possible direction of movement for cyclists, a sign with an arrow indicating the direction of move to which the light signal relates shall be placed below the traffic lights referred to in paragraph (1) as per Annex 6.

Article 22. The following additional means of signalling may also be used when regulating the

movement of RTVs with three-sectioned traffic lights:

1. a device for indicating the duration of the light signal, having the form of a square with a black background, as per Annex 7, on which a digital matrix with green or red digits of a number other than zero, corresponding to the number of seconds remaining to the end of the green and red signal respectively, indicates the duration of the signal without interruption from its beginning to its end;

2. an additional signal section with a flashing yellow light, with an image of the road user to be passed through, to increase the attention of drivers who are making a right turn but must pass another road user before doing so (when crossing tram, cycle and/or pedestrian infrastructure). The light section shall be in working condition during matching clearance signals for right-turning directions and traffic participants to be passed through. The additional section shall have the form of a circle having a diameter of not less than 300 mm.

Section III.

Traffic lights intended to prohibit and authorise road vehicles to enter a traffic lane

Article 23. (1) In order to prohibit and allow RTVs to enter a reversible flow traffic lane, a traffic light with two sections shall be used to provide signals with non-flashing red and green lights.

(2) The traffic light fields referred to in paragraph (1) shall have the shape of a square having a side of at least 300 mm with a black background.

(3) The light field, which emits a red light, shall be in the shape of two inclined intersecting bars forming the letter ‘X’. The light field emitting green light shall have the shape of an arrow directed downwards.

(4) In cases where the light fields of the traffic lights referred to in paragraph (1) are outlined in separate sections, they shall be placed:

1. horizontally, with the section emitting red light on the left and the section emitting green light to the right as per Annex 8, letter (a);

2. vertically, with the section emitting red light positioned above and the one emitting green light positioned below, as per Annex 8, letter (b).

(5) The sequence of light signals emitted by double-sectioned traffic lights shall be as follows:

1. green light;

2. red light;

3. green light.

Article 24. (1) In cases where both sections of the traffic lights prohibiting and permitting RTVs to enter the traffic lane over which they are placed are inoperative, the direction of traffic in the reversible flow traffic lane shall be further indicated by traffic signs.

(2) In the cases referred to in paragraph (1), where there is no traffic sign, traffic in the reversible flow traffic lane is prohibited.

Section IV.

Traffic lights intended to prohibit vehicles from passing over a railway crossing

Article 25. (1) To prohibit RTVs from passing through a railway crossing, a traffic light with one or two horizontally placed illuminated fields shall be used as per Annex 9.

(2) The traffic light fields at a railway crossing shall be circular with a diameter of 200 or 300 mm.

(3) The traffic light emits one or two consecutively flashing light signals in red colour. Simultaneously with the light signals, a sound signal must also be emitted.

(4) The emission of the signals referred to in paragraph (3) shall commence at least 30 s before the rail vehicle passes over the level crossing and shall cease no earlier than 5 s after the level crossing is clear.

(5) Traffic lights used to regulate the traffic of RTVs at a level crossing may also be placed in front of mobile bridges, ferries, ports and places where motor vehicles (RVs) with a special traffic regime enter the road.

Article 26. In cases where the visibility of the light signals emitted by the traffic light for the imposition of a ban on RTVs crossing a railway level crossing is not ensured, it shall be preceded by a single-section traffic light, which shall emit one or two alternately flashing yellow light signals. This traffic light shall be located at a distance of 100 to 150 m before the level crossing and shall begin to provide light signals at the same time as the traffic light on the level crossing.

Article 27. To indicate to the traffic participants that the traffic light system is in working order at the time when the traffic lights at the level crossing do not emit a red flashing signal, a slow flashing signal with a moon-white colour shall be used. This signal shall be emitted by an additional traffic light section placed under the sections providing the signal with a red flashing light.

Section V.

Traffic lights intended to regulate the movement of vehicles of the scheduled public passenger transport services (SPPTS)

Article 28. (1) To regulate the movement of vehicles of the SPPTS a traffic light with four

illuminated fields in the shape of the letter ‘T’ on a black background shall be used. Three of the fields shall be placed horizontally side by side and below them shall be the fourth field positioned according to Annex 10.

(2) The traffic light referred to in paragraph (1) shall emit light signals in accordance with Article 10.

(3) In the case of entrance to a regulated zone a traffic light shall be installed to regulate the movement of vehicles of the SPPTS, their drivers shall be guided by its signals, regardless of the signals of the three-sectioned traffic light under Article 13(1), if any.

Article 29. The illuminated fields of a traffic light intended to regulate the movement of vehicles of the SPPTS shall be round with a diameter of 60 to 100 mm.

Article 30. Where a tram passes through a regulated zone, its movement shall be regulated by a separate traffic light as per Article 28(1).

Article 31. A stand-alone traffic light according to Article 28(1) to regulate the movement of non-rail vehicles of theSPPTS shall be used in the event that there is a dedicated specialised ‘BUS-lane’or a shared ‘BUS-lane’.

Section VI.

Traffic lights to regulate the movement of pedestrians

Article 32. (1) A two-sectioned traffic light is used to regulate pedestrian traffic, with red and green colour signals.

(2) Traffic lights shall be arranged vertically, with:

1. the section emitting red light positioned at the top;

2. the section emitting the green light positioned at the bottom.

(3) The field emitting red light shall be in the shape of a pedestrian standing still and that emitting green light shall be in the shape of a moving pedestrian, in accordance with Annex 11.

(4) The light-emitting fields referred to in paragraph (3) shall be placed on a black background in the shape of a square of 200 mm side.

(5) In order to regulate the movement of pedestrians and cyclists simultaneously, a two-sectioned traffic light may be used on designated cross-walks located immediately adjacent to each other, which shall be signalled by a red and a green light. The field emitting red light shall be in the shape of a pedestrian standing still and a bicycle underneath, and the one emitting green light shall be in the shape of a moving pedestrian and a bicycle underneath, according to Annex 12.

Article 33. (1) The sequence of pedestrian light signals emitted by traffic lights shall be as follows:

1. red light;

2. green light;

3. red light.

Article 34. (1) For the convenience of pedestrians who are visually impaired, the green signal shall be accompanied by an audible signal, whereby in the different directions of the intersection the signal shall have a different sound and/or a different duration of the sound and/or of the pause.

(2) The frequency of the sound referred to in paragraph (1) shall be in the range of 800 to 2,000 Hz and, where the audible signal has pulsations, they shall have a frequency of up to 4 Hz ± 0.2 Hz, and the ratio of the duration of the sound and the break shall be greater than 1. The volume of the sound under paragraph (1) shall be no more than 5 dB(A) above the background noise level at the regulated zone.

(3) The audible signal referred to in paragraph (1) shall have an increased pulsation frequency during the green flashing warning signal.

(4) The audible signal referred to in paragraph (1) shall be directed along the pedestrian walkway for which it is intended and shall end with the end of the corresponding green pedestrian signal.

(5) If the audible signal referred to in paragraph (1) shall be claimed by pushing of a special button, the button shall produce a sound indicating its location which shall stop after its activation.

(6) The frequency of the sound emitted by the button shall be at least three times lower than that of the sound referred to in paragraph (1). The volume of the sound for orientation shall ensure its perception at a distance of up to 2 m from it.

(7) The elements of the intersection and pedestrian space shall be shaped in accordance with the requirements of Regulation No RD-02-20-2 of 26.1.2021 laying down the accessibility and universal design requirements for the elements of the accessible environment in the urbanised area and of buildings and facilities (SG issue No. 12/2021) (Regulation No RD-02-20-2/2021).

Chapter Four.

Criteria for determining the need to use traffic light signals

Article 35. (1) The use of light signals to control the movement of RTVs and pedestrians is appropriate where one of the following conditions is met:

1.At an intersection or ingress/egress into/of a property or building - where the volume of through traffic, measured in converted units per hour (E/h) over 8 consecutive or non-consecutive hours of a weekday between 07.00 and 20.00, is not less than the following values:

Number of traffic lanes for traffic in one direction by:		Intensity of movement in both directions on a road with greater intensity of movement	Intensity of movement on transverse path to the direction of movement with greater intensity
on a road with a higher traffic intensity	transverse road	units moved per hour (E/h)	units moved per hour (E/h)
1	1	750 670 580 500 410 380	75 100 125 150 175 190
2 and more	1	900 800 700 600 500 400	75 100 125 150 175 200
2 and more	2 and more	900 825 750 675 600 525 480	100 125 150 175 200 225 240

2. On a pedestrian walkway – where the intensity of pedestrian flow in the busier of the two directions is greater than 150 pedestrians/hour and the intensity of traffic of RTVs crossing the pedestrian walkway in both directions for 8 consecutive or non-consecutive hours on a weekday

between 07.00 and 20.00 is greater than:

(a) 1000 (E/h) – on a carriageway with a median dividing strip or dividing island on a carriageway not less than 2,00 m wide;

(b) 600 (E/h) in other cases;

3. On a cycle path – where the volume of cycle traffic on the path in the busier of the two directions is greater than 50 cyclists/hour and the volume of RTVs crossing the cycle path in both directions for 8 consecutive or non-consecutive hours on a weekday between 07.00 and 20.00 is greater than:

(a) 1000 (E/h) – on a carriageway with a median dividing strip or dividing island on a carriageway not less than 2,00 m wide;

(b) 600 (E/h) in other cases.

4. The conditions in points (1), (2) and (3) are not met in full, but two of them are individually met by more than 80 %;

5. Three or more traffic accidents of the type of side-impact or other collisions between vehicles travelling on intersecting streets, collisions of vehicles travelling straight ahead and pedestrians crossing the street have been recorded at the location in question in the past 12 months, head-on collisions between oncoming RTVs travelling straight ahead and turning left, the latter type of collision being taken into account only if a separate phase at the traffic light system is provided for left-turning vehicles;

6. At the exit of a building or property, the intended purpose of which implies that vehicles with a special traffic regime under Article (91)(1) of the Road Traffic Law may exit the building/property, the traffic light system shall be switched on when a vehicle with a special traffic regime exits the building or property;

7. For the design of new and the reconstruction of existing infrastructure, the criteria for the construction of a new traffic lights system under points (1), (2) or (3) shall also include estimated intensity values to be provided by the owner or the administration managing the road.

(2) In a locality with fewer than 10 000 inhabitants, the installation of a traffic lights system shall be permitted if 70 % of the conditions set out in paragraph (1), points (2), (1), (3) or (5) are met.

(3) At an intersection located on an accessible route in accordance with Regulation No. RD-02-20-2 of 2021, the installation of a traffic lights system shall be permitted without meeting the conditions of paragraph (1) and (2). The traffic lights system works with flexible control with phase request by the pedestrians.

(4) In the case of coordinated operation of traffic light systems, where the distance between two

adjacent traffic light systems is greater than 800 m, it shall be permissible to place an additional traffic lights system between them, irrespective of whether the conditions of paragraphs (1) and (2) are met.

Article 36. (1) A coordination of the operation of traffic light systems along a specific route shall be appropriate when the distance between intersections is less than 800 m.

(2) If it is not possible to achieve effective coordination in both directions of travel, a priority direction of travel shall be determined for the different periods of the day.

(3) For the design of the coordination, a speed of between 70 % and 100 % of the permitted speed shall be used and, in specific situations, the speed shall be determined by means of trial trips over the coordinated section of the road network.

(4) For intersections with traffic intensity lower than the other intersections in the coordinated section or the pedestrian walkways regulated by traffic lights, a cycle duration equal to 1/2 of the cycle duration of the coordinated group of intersections may be used.

Article 37. Traffic lights to prohibit and allow RTVs to enter the traffic lane shall be used in the event of a periodic change of direction on the traffic lane over which they are placed. A reversible flow traffic lane shall be used where:

1. the difference in traffic intensity of the RTVs in the two opposite directions is more than 500 E/h;

2. the traffic intensity is fluctuating periodically by hours of the day or days of the week;

3. at least three lanes are present in both directions.

Article 38. (1) A device for counting the duration of the light signal shall be placed only at an entrance to a regulated zone for which the corresponding traffic volume values exceed by at least 30 % those specified in Article 35(1), points (1), (2) or (3).

(2) The device referred to in paragraph (1) shall not be placed on traffic light systems the control cycle duration of which is adjustable in real time.

Chapter Five.

Requirements for the technical devices used to regulate the traffic by light signals

Article 39. The traffic light systems and the technical devices used for their construction shall meet the requirements of BDS EN 12368 ‘Traffic control equipment - Signal heads’ (BDS EN 12368), BDS EN 50293 ‘Road traffic signal systems - Electromagnetic compatibility’, BDS EN 12352 ‘Traffic control equipment - Warning and safety light devices’, BDS EN 12675 ‘Traffic signal controllers - Functional safety requirements’.

Article 40. The traffic light shall meet the following requirements:

1. each section shall have an individual energy-saving LED light source independent of the sources of the other sections;

2. the light fields shall be illuminated evenly;

3. the light sources shall be of enhanced reliability and durability according to BDS EN 12368;

4. each section shall have a sunshade (visor) in accordance with Annex 13, the construction of which allows improved visibility of the signal by the traffic users for whom it is intended and limits its visibility to road users to whom it does not apply;

5. the construction of the section limits the possibility of obtaining a ‘phantom effect’ according to BDS EN 12368.

Article 41. (1) In the event of a need to improve the visibility of traffic light signals, a contrasting screen shall be placed around the traffic light with an inner stripe coloured in yellow and a black border as per Annex 14.

(2) The size of the screen referred to in paragraph (1) shall depend on the size of the visible diameter of the traffic light fields as per Annex 14. The width of the black inner stripe shall not be less than 80 mm.

Article 42. The device controlling the change of light signals of the traffic light sections (the controller) shall meet the following requirements:

1. it shall provide the ability to adjust the duration of the light cycle, the main step and the transition intervals in 1 s;

2. it shall have protection against simultaneous switching on of a green light with a red and/or yellow light from one traffic light;

3. it shall provide protection against signals from a given traffic lights system allowing the simultaneous passing of RTVs and pedestrians in conflicting directions;

4. it shall provide protection against a signal that allows the passing in a given direction in the absence of a signal that prohibits the passing of RTVs in conflicting directions;

5. it shall monitor the correct operation of traffic light sections with red light;

6. it shall ensure automatic operation of the transition intervals when the light signals are switched manually;

7. it shall provide protection against violation of the sequence of light signals;

8. it shall ensure protection against blocking of the traffic lights system during automatic control, resulting in a traffic light cycle duration greater than 180 s;

9. in the event of a malfunction of the traffic light system, endangering the traffic safety, it shall provide an automatic shutdown or switching to the ‘yellow flashing light’ mode of operation;

10. it shall be based on a microprocessor technology;

11. it shall provide the possibility of installing a device for periodic or real-time transmission of traffic lights system operation data and for receiving commands;

12. it shall provide the ability to communicate via a communication protocol for remote monitoring and control of its operation;

13. it shall provide control for the presence of parasitic voltages above 30V at the electrical outputs of the controller;

14. it shall have the ability to record detailed events and errors in the controller's archive (locally in the controller's internal memory).

Article 43. The traffic lights and the additional devices for signalling referred to in Article 22 shall be coloured matt black, and the poles and brackets on which they are mounted and the means used for fixing them shall be coloured in grey, matt blackyellow or silver colour, at the discretion of the owner or administration managing the road. The poles and brackets as well as the fasteners shall be hot-dip galvanized in accordance with BDS EN ISO 1461 'Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461: 2022)', with an average coating mass not less than the requirements in Table 3, and for fasteners – those in Table 4, of the same standard.

Chapter Six

Control of light signals

Article 44. (1) The change of the light signals given by a traffic lights system shall be carried out:

1. by a controller (automatic control mode);

2. manually by an operator (manual control mode);

3. remotely by traffic management software.

(2) The traffic lights system controller shall automatically provide information on the introduction and termination of the manual control at a location determined by the owner or the administration managing the road.

(3) When operating the traffic lights system in a manual mode, the operator shall determine the sequence and duration of the main steps. The duration of the transition intervals between the main steps shall be pre-set and performed automatically.

(4) The manual control shall be applied as an exception - in the event of a traffic accident, where a route for vehicles with a special traffic regime is provided, at public events, where a temporary traffic organization is introduced and in other circumstances creating difficulties for the movement of RTVs and pedestrians. The manual control shall be stopped as soon as the reason for its introduction has

ceased to exist.

(5) In the case of operation of the traffic light system in automatic control mode, the duration of the traffic light cycle and light signals, the timing of their change as well as the duration of the transition intervals:

1. can be defined in advance - fixed program control;

2. may be determined in the process of operation of the traffic lights system in accordance with the parameters of the flows of RTVs and pedestrians whose movement is regulated - flexible control.

(6) The fixed program control can be implemented with one or several predefined programs. The change of programmes shall be appropriate in cases where the volume of RTV traffic flows changes by more than 15 per cent compared to the daily volume between 06.00 and 22.00 hours.

Article 45. In flexible control mode, RTV flow parameters shall be determined in real time by detectors, with pedestrian flow parameters determined by push-buttons and flows of cyclists – by detectors or push-buttons.

Article 46. (1) The owner or administration managing the road shall provide, for each traffic light system, a logbook (protocol) indicating the time when the system is switched on and switched off, the mode in which it operates, the time of the change of operating modes and the reasons why this is being carried out.

(2) The information referred to in paragraph (1) shall be automatically transmitted by the traffic lights system controller at a location designated by the owner or administration managing the road and shall be stored for a period of not less than 5 years.

Chapter Seven

Installation of traffic lights

Article 48. (1) A traffic light to regulate RTV traffic at intersections, pedestrian walkways, narrowed and other sections of road shall be placed:

1. on the right side of the road in the direction of movement – in accordance with Annex 15, letter (a);

2. above the road – according to Annex 15, letter (b);

3. on the right and on the left side of the road – according to Annex 15, letter (c);

4. in the middle above the intersection – according to Annex 15, letter (d).

(2) Where the required visibility of light signals is not ensured, they shall be duplicated by additional traffic lights. The additional traffic light shall be placed:

1. above the road – according to Annex 16, letter (a);

2. on the left side of the road in the direction of traffic, according to Annex 16, letter (b);

3. at the exit of the intersection – according to Annex 16, letter (c).

(3) The additional traffic light shall be placed in such a way that its signals cannot mislead road users for whom they are not intended.

(4) No additional traffic light shall be placed at the exit of an intersection for left-turning vehicles when the signal permitting their passage and the transition period thereafter coincide even partially with the signal permitting the passage of oncoming vehicles.

(5) The additional devices referred to in Article 22, which are used to regulate traffic on roads with three-sectioned traffic lights, shall be placed as follows:

1. the device measuring the duration of the light signal shall be placed on the support of the traffic light at the entrance to the regulated zone in accordance with Annex 17, point (a) and only one device may be placed for RTVs entering the regulated zone within one main step;

2. the additional section emitting a flashing yellow light with an image of the road user, in accordance with Article 22(3), shall be placed on the support of the traffic light on the right-hand side in the direction of the traffic under/at a traffic light section and/or under/at a traffic light section on the right-hand side at the exit of the intersection.

Article 49. (1) A two-sectioned traffic light prohibiting and permitting the entry of RTVs in a particular lane shall be positioned in the median position above the lane for which it is intended in accordance with Annex 18.

(2) The spacing between traffic lights under paragraph (1) positioned along the carriageway shall be such as to ensure that the signals of at least one traffic light are visible to drivers of RTVs at all times.

Article 50. The traffic light prohibiting RTVs from crossing a level crossing shall be placed before the level crossing on the right hand side of the road in the direction of the traffic. Its signals can be duplicated by placing an additional traffic light on the left side of the road, above it or on a separate island on the carriageway.

Article 51. (1) The traffic light to regulate the movement of vehicles of the SPPTS shall be placed:

1. on the support of the three-sectioned traffic light regulating the RTV traffic – according to Annex 19, point (a);

2. independently, before the regulated zone on the right side of the road, in the direction of traffic, where there is no traffic light to regulate the movement of RTVs.

(2) Where there is a dedicated lane for the movement of vehicles of the SPPTS, the traffic light under paragraph (1) shall be placed on the island constructed to form a stopping point in accordance

with Annex 19, point (b), or in another position which ensures visibility of the signals, on the right-hand side in the direction of traffic.

Article 52. (1) Double-sectioned traffic lights to regulate pedestrian traffic shall be placed opposite each end of the pedestrian walkway, to the right in the direction of pedestrian traffic in accordance with Annex 20, point (a), or between the pedestrian walkway and the cycle path in the case of Article 32(5).

(2) Where there is a median strip or island on the carriageway which has a pedestrian waiting section of at least 2.00 m width, two separate pedestrian walkways shall be provided. Double-sectioned traffic lights to regulate pedestrian traffic shall, where technically feasible, be placed opposite each end of each pedestrian walkway, to the right in the direction of pedestrian traffic in accordance with Annex 20, point (b).

(3) The three-sectioned traffic lights to regulate cyclists on cycle infrastructure shall be placed to the right of the direction of traffic before entering the intersection.

(4) In the case of two-way bicycle traffic, where it is not feasible to place a three-sectioned traffic light to the right of the direction of traffic before entering the intersection, they shall be placed above the bicycle infrastructure by a console or at the discretion of the designer so that it shall be clear to which road users they apply. The three-sectioned traffic lights for two-way bicycle traffic shall be located in visible places, in a way that does not interfere with other road users and is safe. The minimum height for installation is 2.40 m, in accordance with the Regulation under Article (75)(4) of the Spatial Planning Act (SPA).

Article 53. (1) Traffic lights shall be fixed according to the specific conditions on gates, rope structures, consoles attached to buildings or other structures.

(2) The load-bearing structures referred to in paragraph (1) shall be securely fixed to the ground, buildings or other structures in such a way as to ensure the necessary conditions for the operation of traffic lights and the safety of road users.

Article 54. (1) The distance from the pavement to the lowest point of the traffic light shall be:

1. From 2.25 to 2.60 m, when the traffic light is positioned on the side of the running lane according to Annex 21 (a);

2. from 5.20 to 6.50 m – when the traffic light is positioned above the lane according to Annex 21 (b).

(2) Where a traffic light is placed on the side of the carriageway, the distance from the edge of the kerb or bank to the nearest point of the traffic light shall be from 0,50 to 2,00 m in accordance with Annex 21, point (a).

(3) The distance in the direction of RTV movement from the stop line to the three-sectioned traffic light on the side of the carriageway may be from 1.00 to 7.50 m, depending on visibility conditions and the location of the pedestrian walkway, in accordance with Annex 22, point (a).

(4) The distance in the direction of movement of the RTV from the stop line to the three-section traffic light located above the carriageway may be from 3.00 to 20.00 m depending on the visibility conditions in accordance with Annex 22, point (b). This distance may be lower in cases where additional traffic lights are fitted and the necessary traffic safety conditions are provided.

(5) The distance from the right-hand edge of the pedestrian walkway in the direction of pedestrian traffic to the two-sectioned pedestrian traffic light shall, depending on the particular conditions, be not more than 2.00 m in accordance with Annex 23.

(6) Wherever possible, the height of the positioning of traffic lights, the lateral distance from the kerb (road bank), the manner of their positioning and the diameter of the illuminated fields along the road shall be the same at one and the same point of regulation and/or on the same street of the primary street network.

(7) The installation of the additional means of signalling referred to in Article 22 shall be subject to the requirements of the preceding paragraphs.

Article 55. (1) The light signals emitted by the three-sectioned traffic lights and the additional means of signalling referred to in Article 22 shall be visible from any point on the carriageway in the area bounded between:

1. the first and the hundredth metre before the traffic light, at running speeds of up to 50 km/h;

2. the first and one hundred and fiftieth metre before the traffic light – at a higher driving speed.

(2) In the absence of a technical possibility to fulfil the requirements under paragraph (1), traffic lights for the control of RTV traffic shall be so placed that the visibility distance of their signals shall be equal to or greater than the length of the stopping distance of a RTV travelling at the permissible maximum speed for the road section concerned, taking into account the influence of adverse road conditions (wet, snowy or icy road surface).

(3) Where the requirements of paragraphs (1) and (2) cannot be fulfilled in a locality, the regulated zone shall be signalled with the traffic sign A24 ‘Traffic light’, according to the Regulation under Article 14(1) of the Road Traffic Law on the conditions and procedure for the use of road signs.

Article 56. The manual control panel of the traffic lights system shall be placed in a position from which it is visible from the waiting areas of the intersections.

Article 57. (1) The button for requesting a pedestrian phase under flexible control in accordance with Article 34(5) shall be placed on the pole on which the traffic lights are fixed, or on a separate pole in the area of the tactile strip marking the beginning of the pedestrian walkway, at a height of 1.00 m from the pavement.

(2) In an appropriate place on the button housing, important information for the orientation of visually impaired people can be provided by tactile signs and/or Braille letters.

(3) Pedestrian buttons referred to in paragraph (1) shall not be illuminated by red or green light.

Article 58. The detectors referred to in Article 45 shall be installed in accordance with the requirements of the manufacturer's technical specification.

Chapter Eight
Design of traffic light systems

Article 59. (1) The construction of a new traffic light system or the reconstruction of an existing one shall be carried out on the basis of an investment project, prepared and approved in accordance with the provisions of the Spatial Planning Act.

(2) If the construction or reconstruction of a road or street provides for the construction or reconstruction of traffic light systems, the design shall be part of the investment project for the road or street.

(3) The traffic lights system investment project shall consist of the following parts:

1. Traffic organisation and safety:

(a) explanatory note with transport and technical calculations according to Article 65;

(b) data on the intensity of RTV and pedestrian traffic flows;

(c) signalization at the regulated zone with road markings and road signs;

(d) layout plan for technical equipment – traffic lights, poles and consoles, controller, inductive frames and/or sensors, buttons, additional means of signalling, etc.;

(e) a plan of the adjustment phases;

(f) cyclograms of traffic light signals and additional means of signalling;

(g) a scheme of interlocks against simultaneous flashing of traffic lights in conflicting flows of RTVs and pedestrians in case the traffic light controller does not have a factory software interlock;

(h) scheme of interlocks against simultaneous flashing of traffic lights in conflicting flows of RTVs and pedestrians in case the traffic light controller does not have a factory software interlock;

(i) bill of materials;

2. Constructive part:

(a) an explanatory note with data on the assumed loads of the structures for fixing the technical means and structural calculations of strength and deformation;

(b) drawings of structures, connections and foundations with relevant details;

(c) bill of materials;

3. Electrical part:

(a) an explanatory note;

(b) details of the controller's power source, installed power and power consumption;

(c) a drawing of details of a single phase cable power supply to the controller with a pipe network;

(d) drawing with details of cable power supply with pipe network from the controller to the poles;

(e) drawing with details of power supply cable between detectors, buttons and controller;

(f) diagrams of the connections between the cable terminal block in the pole and the technical means located on that pole;

(g) detail of the grounding pole;

(h) bill of quantities;

4. a health and safety plan in accordance with the occupational health and safety regulation under Article (276)(1) of the Labour Code:

(a) an explanatory note;

(b) construction situation plan;

(c) drawings with details for the restoration of road and pavement surfaces and green areas destroyed during the construction of the pipe network and the pillars;

(d) drawings for temporary traffic organisation and safety during construction and installation works;

(e) bill of materials;

(4) The investment project under paragraph (3) shall be elaborated by persons having full designer competence for the relevant parts of the Regulation with regard to the scope and content of the investment projects under Article 139(5) of the Spatial Planning Act, as follows:

1. under points 1 and 4, letter (d) – full designer competence with regard to the 'Traffic organisation and safety' part;

2 under point 2 – full designer competence with regard to the 'Constructive' part;

3 under point 3 – full designer competence with regard to the 'Electrical' part.

(5) When devising the design for traffic control with light signals, the following conditions shall be complied with:

1. the passing of incoming RTVs from one entrance to the regulated zone shall be allowed in different phases where separate lanes are provided for them in the waiting area;

2. low-intensity manoeuvres, including turning left, right or reversing, may be prohibited in a regulated zone where they complicate traffic regulation and impair traffic safety;

3. the regulated zones shall be signalled with road markings and road signs in accordance with the requirements of the relevant regulations under Article (14)(1) of the RTL.

Article 60. (1) The number of programmes with which the traffic light system operates shall be determined according to the hourly variation of the volume of the RTV and pedestrian traffic through the regulated zone during the day in accordance with Annex 24. Separate programmes can be developed for weekends and holidays.

(2) On the basis of transport and technical calculations, the duration for each programme of the traffic light cycle, the number, sequence and duration of phases and the duration of the intermediate times shall be determined.

Article 61. (1) The combinations of light signals in the different phases shall be determined in accordance with the specific traffic organisation in the regulated zone.

(2) The number of phases with which the traffic lights system operates shall be sufficient to permit the safe passage of conflicting traffic and pedestrian flows through the regulated zone.

(3) The number of phases referred to in paragraph (2) shall not be less than two and not more than five. It is permissible to use four and five traffic control phases only in case of high traffic volume, complex distribution of RTV and pedestrian flows and where there are four or more entrances to the regulated zone.

(4) Where a group of road users is permitted to pass through a regulated zone in two consecutive phases, their passage shall, where possible, not be interrupted by signals given in the transitional intervals between the phases for other road users.

(5) After the end of the light signal permitting the crossing of the regulated zone, an intermediate time shall be provided for clearing the traffic lane of RTVs and pedestrians in the conflict zone of the regulated area.

Article 62. (1) The duration of the traffic light cycle shall be determined by the number and duration of the phases and the intermediate times. The order of switching traffic light signals is indicated in Annex 25. The cycle shall not last longer:

1. for two-phase motion control, of 70 s;

2. for three-phase motion control, of 90 s;

3. for four- and five-phase motion control, of 120 s.

(2) The restrictions of paragraph (1) shall not apply to the design of flexible control and coordination of the functioning of traffic light systems.

(3) The duration of the traffic light cycle of permanent or portable traffic light systems regulating the movement of vehicles on traffic lanes with successive changes of direction - bottlenecks, may be greater than 120 s.

(4) The shortest duration of the clearance signal shall be:

1. for the passing of non-rail RTVs – 8 s;

2. to allow pedestrians and cyclists to pass – 6 s;

3. for the passing of one tramway formation – 10 s;

4. for the passing of two tramway formations – 20 s.

(5) The activation of a traffic light system to regulate traffic at an intersection or on a pedestrian walkway shall be accomplished by emitting light signals in the following sequence:

1. yellow flashing light on all inputs at the regulated zone with a duration of 15 s;

2. yellow non-flashing light lasting 3 s;

3. red light with a duration of 10 s;

4. start of implementation of the relevant programme.

(6) During the sequence of light signals referred to in paragraph (4), traffic lights for the regulation of pedestrian, cyclist and vehicle traffic of the SPPTS shall emit signals prohibiting passage.

(7) The duration of the yellow light signal shall be:

1. when the signal is emitted after the signal with a green light, 3 s at a permissible maximum vehicle's speed when approaching to the regulated zone of up to 50 km/h; 4 s – up to 60 km/h; 5 s – up to 70 km/h and, when the signal is provided by the traffic light for cyclists, 2 s;

2. if the signal is emitted simultaneously with a red light – 2 s, and when the signal is emitted from the traffic light for cyclists – 1 s;

3. in the case referred to in Article 14(2) – 5 s.

(8) If in the case referred to in paragraph (7)(1) there are RTVs turning at a separated phase with a speed lower than 60 km/h or 70 km/h, the duration of the yellow light signal for the entire approach to the regulated zone shall be assumed to be 3 s.

(9) There may be yellow light signals of different durations on different approaches to an intersection under paragraph (7)(1).

(10) In the case of flashing light signals, the frequency of the flashes shall be 60 ± 5 per minute,

where the duration of the interval during which the light is emitted shall be equal to the duration of the interval during which it is not emitted.

Article 63. (1) For the introduction of a separate phase to regulate the traffic of RTVs turning left or right at an intersection, there shall be at least one lane of traffic for that direction at the entrance to the intersection.

(2) For the introduction of a separate phase to regulate all pedestrian movements at an intersection, the turning RTVs traffic volume during the peak hour needs to be greater than 120 E/h, and the pedestrian traffic volume needs to be greater than 150 pedestrians per hour, calculated as an average of four hours per day (in the interval from 07.00 to 20.00, the hours may not be consecutive), or over 900 pedestrians per hour during the busiest hour and where the longest crossing length is up to 12 m;

(3) For the introduction of a pedestrian phase on demand, it is necessary that the intensity of pedestrian flow passing through the pedestrian walkway is changed periodically over the course of the day and shall not exceed:

1. two hundred pedestrians and/or cyclists per hour, crossing the pedestrian walkway – in a traffic lane without a central reservation strip, arithmetically averaged over four hours per day (between 07.00 and 20.00, hours may not be consecutive);

2. three hundred pedestrians and/or cyclists per hour, crossing the pedestrian walkway – in the presence of an island on the carriageway or a median strip at least 2.00 m wide, arithmetically averaged over four hours per day (between 07.00 and 20.00, the hours may not be consecutive).

(4) The algorithm presented in Annex 26 shall be used to determine the need for a distinct (protected) clearance light signal to regulate the movement of RTVs turning left.

Article 64. (1) The duration and sequence of the light signals emitted by road traffic lights shall be depicted with a cyclogram that determines the optical signal emitted by traffic lights through the traffic cycle. A cyclogram of light signals is shown in Annex 27.

(2) The cyclograms under paragraph (1) shall be drawn up on the basis of the phasing plan, the traffic light layout plan and the traffic engineering calculations. A diagram of traffic control phase plans is shown in Annex 28.

(3) A separate cyclogram corresponds to each operating programme of the traffic lights system.

(4) When a flexible control is used, all cyclogram variations intended for use are presented, visualising the different sequence of light signals as well as the minimum and maximum green light times.

Article 65. The determination of the duration of the intermediate times, of the transition intervals, of the signal clearances and of the cycles of the permanent traffic lights and of the portable

traffic lights according to the Regulation on the temporary traffic organisation under Article (3)(4) of the Road Traffic Law (RTL) shall be carried out according to the methodology in Annex 1.

Article 66. In order to reduce the delay to vehicles of the SPPTS, the following shall be used:

1. a dedicated sensor on the vehicle that requests an extension of the clearance signal of a predetermined duration;

2. a dedicated sensor from the vehicle that requests a phase with a pre-defined duration;

3. ensuring conflict-free entry of vehicles from the BUS lane into the lining and waiting zone (Annex 29).

Chapter Nine

Operation and maintenance of technical means of traffic regulation with traffic lights

Article 67. The owner or administration controlling the road on which a traffic lights system regulating the traffic via light signals is fitted shall be responsible for the integrity of the system, its operation in accordance with the design and its maintenance in accordance with the instructions and prescriptions of the manufacturer of the technical equipment and the requirements of this Regulation.

Article 68. (1) The equipment for the traffic lights system shall be periodically checked for corrosion and deformation. Grounding and safety for passing RTVs and pedestrians shall be checked.

(2) A report shall be drawn up on the findings of the inspection and the measures identified to remedy damage, discrepancies and the like, which shall be approved by the owner or administration managing the road.

Article 69. (1) The illuminated fields and the contrast screen of traffic lights shall be cleaned of dirt not less than once every three months.

(2) In areas with severe environmental pollution, the cleaning referred to in paragraph (1) shall be carried out every month.

Article 70. The owner or administration managing the road:

1. stores and maintains information on the traffic light systems, which shall contain all the baseline data for their construction, the parameters of the programmes and technical installations, as well as the modifications made to them;

2. not less than once a year carries out a study of the parameters of the flows of RTVs and pedestrians at the places regulated by traffic lights and, if necessary, modifies the regulation programmes or plans the reconstruction of the traffic lights system;

3. stores the data on the intensity of RTV and pedestrian traffic, as well as the data on the identified concentration of traffic accidents, on the basis of which the decision to install a traffic lights system was taken.

Additional provisions

§ 1. For the purposes of this Regulation:

1. ‘Transition interval’ is the sum of the intermediate times between two successive phases.

2. ‘Phase’ is the part of the cycle in which a particular combination of RTV and pedestrian flows receives a simultaneous clearance signal.

3. ‘Intermediate time’ is the time between the end of the clearance signal for a flow of RTVs or pedestrians and the beginning of the clearance signal for another flow which is conflicting to the first one.

4. ‘Main step’ is the time interval during which the clearance and prohibition signals shall not be changed.

5. ‘Cycle’ is the time for a complete one time shift of the light signals of a traffic lights system.

6. ‘Programme’ is the totality of the predetermined cycle, sequence, duration and number of phases and intermediate times with which the traffic lights system operates during a given period of time.

7. ‘Conflicting traffic directions (conflicting flows)" - directions/flows of vehicles, pedestrians, cyclists or other road users whose traffic paths intersect in the junction zone.

8. ‘Converted unit’ means a transport unit converted to a passenger car. The coefficients for the conversion of the different types of transport units to a passenger car shall be those in Annex 1 to Article (6) of Regulation No. RD-02-20-2 of 20 December 2017 on planning and design of the communication and transport system of urban areas (SG issue No 7 of 2018).

9. ‘Phantom Effect’ is the perception of a "false" light signal from a traffic light section when the internal source is switched off as a result of light reflected from the traffic light by the sun or other external source.

10. ‘Pedestrian or bicycle push button’ is a device which provides an electrical signal when pushed or triggered by a hand proximity sensor by a pedestrian or cyclist, which registers an intention to cross the pedestrian walkway or the cycle path.

11. ‘Detector’ is a device that converts the primary signal from inductive frames, sensors and buttons and feeds information to the controller.

12. ‘Speed of movement’ means:

(a) the average design speed of the relevant road section Ve - for a new road;

(b) the actual speed of V85, which shall not be exceeded by 85 per cent of the drivers of

passenger cars, but shall not exceed the speed values set for category B in Article (21)(1) of the Road Traffic Law - for an existing road.

13. 'Reversible flow traffic lane' is a lane on which the direction of traffic may change periodically.

§ 2. The cited standards apply in their current versions, with the exception of harmonised standards within the meaning of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, to which the version referred to in the Official Journal of the European Union shall apply.

Transitional and final provisions

§ 3. The Regulation is issued on the basis of Article (14)(1) of the Road Traffic Law.

§ 4. The conversion of existing traffic light systems in accordance with Article 21, Article 40(1), Article 42 and Article 57 of the Regulation shall be carried out within two years of the date of its entry into force.

§ 5 (1) The proceedings initiated for the approval of an investment project and the issuance of a construction permit shall be completed in accordance with Regulation No. 17 of 23 July 2001 on the regulation of traffic on roads with traffic lights.

(2) For proceedings initiated under paragraph. 1 shall be deemed to be the date of submission of a written application for approval of the investment project by the competent authority.

§ 6. The Regulation shall enter into force six (6) months from the date of its promulgation in the State Gazette.

MINISTER
OF REGIONAL DEVELOPMENT
AND PUBLIC WORKS: **VIOLETA KORITAROVA - KASABOVA**

MINISTER
OF THE INTERIOR: **KALIN STOYANOV**

MINISTER FOR TRANSPORT
AND COMMUNICATIONS: **GEORGI GVOZDEYKOV**

Annex 1 to Article 2 and Article 65

Methodology

for determining the duration of intermediate times, transition intervals, signal clearances and the cycle of fixed and portable traffic light systems

A. Fixed traffic light systems

1. Intermediate times for lane clearance for RTVs and pedestrians in the conflict zone at the regulated zone (Article 61(5))

1.1. Approach time of the RTV to the stop line at the end of the clearance signal – t_as:

1.1.1. For cars $t_{a,c}$:

(a) moving straight: $t_{a,c}$= 3 s at $V_{clr,c}$= 36 km/h (10 m/s); (1)

(b) turning at radius R ≥ 10 m with $V_{clr,c}$= 25.2 km/h (7 m/s) or at radius of R <10 m with $V_{clr,c}$= 18.0 km/h (5 m/s): $t_{a,c}$= 2 s (2)

1.1.2. For trams $t_{a,t}$:

(a) approact at speed $V_{a,t}$ equal to the maximum permitted speed $V_{max,t}$ ($V_{a,t}$= $V_{max,t}$= 40 km/h) – no stop or with a stop after the regulated zone: $t_{a,t}$= 0.5 + [$V_{max,t}$/(2.4 * 3.6)] = 0.5 + (11.1/2.4) = 5.1 s; (3)

(b) approact at speed $V_{a,t}$ less than the maximum allowed speed $V_{max,t}$ ($V_{a,t}$<$V_{max,t}$) – from a stop in front of the regulated zone: $t_{a,t}$= 0. (4)

1.1.3. For pedestrians $t_{a,p}$: $t_{a,p}$= 0. (5)

1.1.4. For cyclists $t_{a,b}$: $t_{a,b}$= 1 s (5′)

1.2. Time to clear the conflict zone from the vehicle or pedestrian – t_{clr}, s:

1.2.1. For cars $t_{clr,c}$ (Figure 1, Figure 2):

(a) clear at speed $V_{clr,c}$ equal to the maximum permitted speed $V_{max,c}$ ($V_{clr,c}$= $V_{max,c}$= 50 km/h): $t_{clr,c}$= 3.6 * ($l_{clr,c}$+ l_c)/$V_{clr,c}$= 3.6 * ($l_{clr,c}$+ 6)/$V_{clr,c}$ (6) where l_c is the length of a passenger car;

(b) clear at speed $V_{clr,c}$ less than the maximum allowed speed $V_{max,c}$ ($V_{clr,c}$< $V_{max,c}$):

1. $v_{clr,c}$= 10 m/s ($V_{clr,c}$= 36 km/h) – when moving straight – $t_{clr,c}$= ($l_{clr,c}$+ 6)/10; (7)

2. $V_{clr,c}$= 7 m/s ($V_{clr,c}$= 25.2 km/h) – in case of turning with radius R > 15 m – $t_{clr,c}$= ($l_{clr,c}$+ 6)/7; (8)

3. $V_{clr,c}$= 5 m/s ($V_{clr,c}$= 18 km/h) – in the case of turning with a radius of 6 m<R<15 m – $t_{clr,c}$= ($l_{clr,c}$+ 6)/5; (9)

The condition $t_{a,c}+t_{clr,c}\geq t_y+1$ (9′) must be fulfilled, where t_y is the duration of the corresponding yellow signal.

1.2.2. For tram $t_{clr,t}$ (Figure 3):

(a) clear at speed $V_{clr,t}$ equal to the maximum permitted speed $V_{max,t}$ ($V_{clr,t}$= $V_{max,t}$= 40 km/h) – no stop or with a stop after the regulated zone: $t_{clr,t}$= 3.6 * ($l_{clr,t}$+ l_t)/$V_{clr,t}$ (10) where l_t is the length of the tram, the greatest length of passing trams shall be assumed; the value of l_t is typically from 22 to 30 m;

(b) clear at speed $V_{clr,t}$ less than the maximum allowed speed $V_{max,t}$ ($V_{clr,t}$< $V_{max,t}$= 40 km/h) – from a stop in front of the regulated zone (tram acceleration at departure a_t= 1.0 m/s^2): $t_{clr,t}$={2*($l_{clr,t}$+l_t)/a_t}^0.5 (11) – with $l_{clr,t} \leq$ 40 m and $t_{clr,t}$= 11.1 + ($l_{clr,t}\leq$40) m and $t_{clr,t}$=11.1+($l_{clr,t}$ -40)/11.1 (11 ') – for $l_{clr,t}$ > 40 m.

1.2.3. For pedestrians $t_{clr,p}$:

Clear at speed $v_{clr,p}$= 1.2 – 1.5 m/s, the value shall be assumed depending on the local conditions of the regulated zone and the nature of pedestrian flow – $t_{clr,p}$= $l_{clr,p}$/$V_{clr,p}$. (12)

1.2.4. For bicyclists $t_{clr.b}$:

Clear at speed

$V_{clr,b}$= 4.0 m/s – $t_{clr,b}$= $l_{clr,b}$/$V_{clr,b}$= $l_{clr,b}$/4.0. (12 ′)

1.3. Time to reach the conflict zone by the departing vehicle at the beginning of the next clearance signal – t_r s:

<u>1.3.1. For cars $t_{r,c}$ (Figure 1) (Figure 4):</u>

(a) reaching the zone when departing from standstill position (vehicle acceleration at departure a_c= 2 m/s^2): $t_{r,c}$={[2*($l_{r,c}$+1.5)/a_c]^0.5}-1= [($l_{r,c}$+1.5)^0.5]-1 (13), where $l_{r,c}$ is the distance from the stop line to the conflict zone;

(b) when reaching with a ‘flying start’ at speed $V_{r,c}$= 40 km/h (usually when the corresponding flow of vehicles is moving in coordinated mode) – $t_{r,c}$= 3.6*$l_{r,c}$/$V_{r,c}$ (14)

<u>1.2.3. For tram $t_{r,t}$ (Figure 3):</u>

(a) reaching the zone, when departing from a stop in front of a regulated zone (tram acceleration at departure a_t=1 m/s^2): $t_{r,t}$={[2*($l_{r,t}$+1.5)/a_t]^0.5}=[2*($l_{r,t}$+1.5)]^0.5; (15)

(b) when reaching the zone with a 'flying start' at speed $V_{r,t}$ equal to the maximum permitted speed $V_{max,t}$ ($V_{r,t}$= $V_{max,t}$= 40 km/h) – no stop or with a stop after the regulated zone: $t_{r,t}$= 3.6*$l_{r,t}$/$V_{r,t}$ (16)

1.3.3. For pedestrians $t_{r,p}$ (Figure 3):

$t_{r,p}$= 0 (17); depending on the specific conditions of the regulated zone, $t_{r,p}$≠0, then $t_{r,p}$= $l_{r,p}$/$v_{r,p}$= $l_{r,p}$/1.5 (18) where the speed of reaching the conflict zone by the pedestrian $v_{r,p}$= 1.5 m/s ($V_{r,\,p}$= 5.4 km/h).

1.3.4. For byclists $t_{r,b}$ (Figure 3):

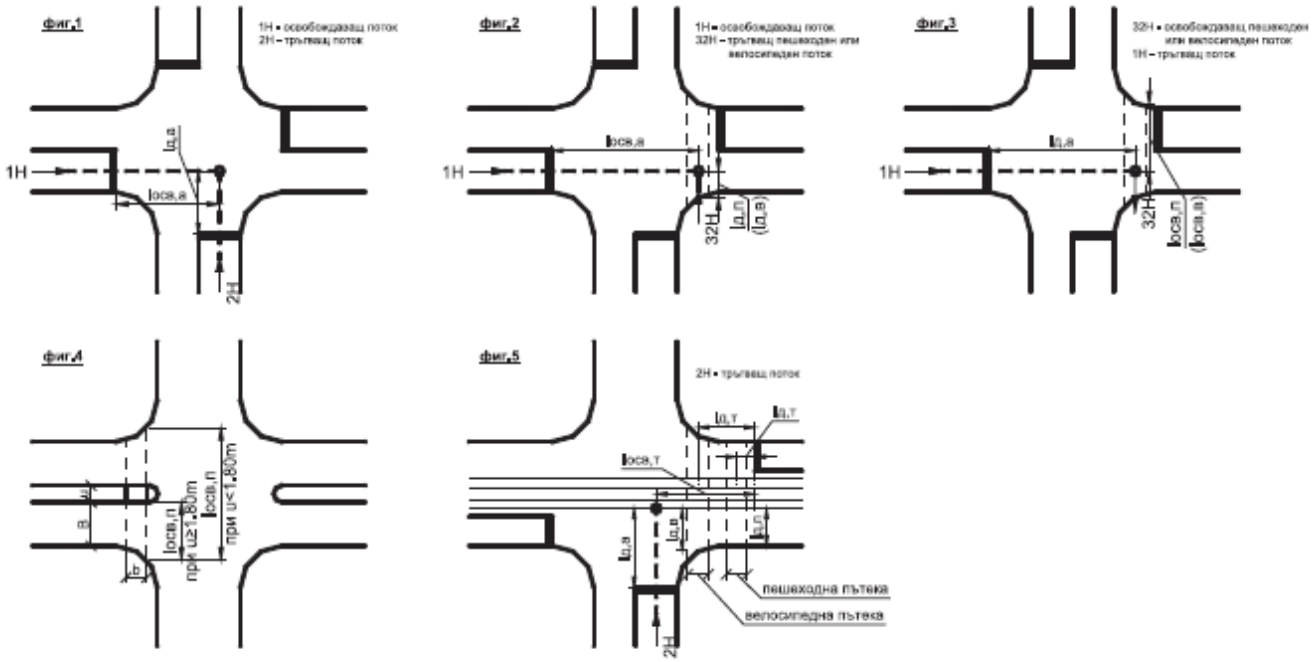
$t_{r,b}$= 0 (17 ′); depending on the specific conditions of the regulated zone, where $t_{r,b}$ ≠0, then $t_{r,b}$= $l_{r,b}$/$v_{r,b}$= $l_{r,b}$/5.0 (18 ′) where the speed at which the conflict zone is reached by the bicyclist $v_{r,b}$= 5.0 m/s ($V_{r,b}$= 18 km/h).

1.4. Intermediate lane clearance times for RTVs and pedestrians in the conflict zone at the regulated zone – t_M^i:

t_M^i= t_a^i+ t_{clr}^i- t_r^{i+1} (19) where t_r^i and t_{clr}^i are the relevant times for each flow, ending its movement in phase i and conflicting with starting movement at i+1 phase.

For each flow the value of t_ri + t_{clr}^i shall be calculated for cases (a) and (b) and the greater of them shall be accepted. In the case a clearing turning vehicle flow, the values calculated in formulae (2), (8) and (9) shall be valid. Formula (19) shall be used to calculate for each clearing flow the value of t_M^i and then to plot it in the intermediate times matrix (Figure 4).

When there are more than two phases of adjustment, their sequence shall be chosen so that the sum of the corresponding t_M^i is the smallest.



MATRIX of intermediate times, s

Освобождаващи потоци		Тръгващи потоци										
		автомобили				трамваи		пещеходци				велосипеди
		1Н	2Н	3Н	4Н	21Н	22Н	31Н	32Н	33Н	34Н	41Н
автомобили	1Н											
	2Н											
	3Н											
	4Н											
трамваи	21Н											
	22Н											
пещеходци	31Н											
	32Н											
	33Н											
	34Н											
велосипеди	41Н											

Clearing flows		Departing flows										
		cars				trams		pedestrians				bicycles
		1H	2H	3H	4H	21H	22H	31H	32H	33H	34H	41H
cars	1H											
	2H											
	3H											
	4H											
trams	21H											
	22H											
pe	31H											

destrians	32H						
	33H						
	34H						
	41H						

Figure 6

2. Duration of signal clearances, t_h s:

The duration of the signal clearances for the individual traffic and pedestrian flows at the regulated zone shall be determined by their intensity.

2.1. For cars:

2.1.1. The coefficients applied for the conversion of RTVs into a converted unit shall be according to § 1, point (8) of the Additional Provision.

2.1.2. Determination of the initial value of the saturated flows s^I for each phase and for each entrance at the regulated zone.

2.1.2.1. For moving straight:

S^I= 525*w [E/h] for w>5.40 m (20), where w is the width of the entrance for that phase;

for w≤5.40 m – acc. to Table 1:

w, m	3.00	3.25	3.30	3.50	3.60	3.75	4.00	4.20	4.50	4.80	5.00	5.40
S^I	1850	1870	1875	1925	1950	1980	2030	2075	2275	2475	2585	2700

2.1.2.2. For turning on a curve with radius R:

(a) in one line – S^I= 1800/(1+1.525/R) [E/h]; (21)

(b) in two lines – S^I= 3000/(1+1.525/R) [E/h]. (22)

2.1.3. Correction coefficients for the conditions at the regulated zone:

2.1.3.1. For the longitudinal slope of the corresponding entrance as the average of the slopes at 60 m before the stop line – K_i= 1-0.03*i (23), where i is the longitudinal slope in percent (i > 0 for climbing and i <0 for descending).

2.1.3.2. For the conditions of movement K_c, acc. to Table 2:

Conditions	Description of the conditions	K_c
Good	Little or no impact of stopped vehicles on pedestrian traffic. Good overview of the regulated zone, sufficient width of its exits.	1.20
Medium	Average traffic conditions. It has characteristics from the “good conditions” and “poor conditions” groups.	1.00
Poor	Low average traffic speed, impact of stopped cars, pedestrians, left turn with waiting. Poor overview of the regulated zone, insufficient width of its exits. Presence of shops in the area of the regulated zone.	0.85

2.1.3.3. For turning traffic K_{turn} (in mixed lanes: straight - right, straight - left and straight - right - left):

(a) share ‘p’ of the turning movement Q_{turn} [E/h] in the mixed lane of the total traffic Q_{total} [E/h] in this lane – $p = 100*Q_{turn}/Q_{total}$ (24) where Q_{turn} is the sum of those moving to the left Q_{left} and of those moving to the right Q_{right} in this band:

- at $p < 10\ \%$ $K_{turn} = 1$; (25)
- at $p > 10\ \%$ $K_{turn} = 100/(a + 1.75b + 1.25c)$, (26) where:

a is the share of straight traffic in the mixed lane, in percent;

b is the share of straight traffic in the mixed lane, in percent;

c is the percentage of the total traffic moving to the right in the mixed lane, in percent.

(b) Q_{total} for the mixed lane may be: $Q_{total} = Q_{turn} + (Q_{straight}/n_{straight})$, (27) where $n_{straight}$ is the number of lanes running directly at the entrance to the regulated zone;

$Q_{straight}$ is the intensity of movement directly at the entrance to the regulated zone in E/h.

2.1.4. Determination of the final value of the saturated flows ‘s’ for each phase and for each entrance of the regulated zone: $s = s^l * K_i * K_t * K_{turn}$ [E/h]. (28)

2.1.5. Determination of phase factors ‘y’ for each input, for each flow at each phase: $t = Q/s$ (29), where Q is the flow rate, E/h, s is the saturated flow, E/h.

2.1.6. Determination of the phase factor for phase i, y_i ($1 \le i \le f$), where f is the number of phases, the maximum value of y from all inputs involved in phase i.

2.1.7. Determination of time loss L in the control cycle:

For phase i: $L_i = t_M^i - 2 + t_{loss}^{start} = t_M^i - 2 + 1 = t_M^i - 1$ (30), where 2 s is the duration of the yellow input signal used and t_{loss}^{start} — time lost when the vehicle starts after the clearance signal is displayed.

For the regulation cycle: $L = {}_1\sum^f L_i = {}_1\sum^f (t_M^i - 1)$ (31).

If there is a pure pedestrian, cyclist or tramway phase, its duration together with its t_M^i shall be added to L.

2.1.8. Determination of the optimum duration of the control cycle T_c:

$T_c = (1.5*L+5)/1-{}_1\sum^f y_i$ (32) – in the absence of pedestrians and/or tram at the regulated zone; $T_c = [L/(1-{}_1\sum^f y_i)]*[120*(1-{}_1\sum^f y_i)/L]^{0.5}$ (33) – in the case of pedestrians and/or tram present at the regulated zone.

2.1.9. Determination of the duration of car signal clearances:

Effective duration $t_{з,i}^{ef} = (y_i/{}_1\sum {}^f y_i)*(T_c - L)$ (34); $t_{h,i}^{ef} = t_{h,i} - t_{loss}^{start} + 2 = t_{h,i} - 1 + 2 = t_{h,i} + 1$. (35)

Duration $t_{h,i} = t_{h,i}^{ef} - 1$. (36)

Inspection: $1.{}_1\sum^f t_{з,i} + {}_1\sum {}^f t_M^i = T_c$; (37)

2. $t_{h,i} \geq 8$ s (38), if not fulfilled, correct $t_{h,i}$ and recalculate T_c and $t_{h,i}$.

2.2. For trams $t_{h,i}^{t}$ — depending on the intensity of the $M_{trams.}$ composition/hour/in direction and the cycle T_c by formula (33), by Table 3:

$M_{trams.}$	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
T_c	120	113	106	100	95	91	87	82	79	75	72	69	67	65	63	60	58	56	54	53

If the cycle calculated according to Formula (33) is less than or equal to the T_c value given in Table 3 for the relevant $M_{trams.}$, it shall be assumed that $t_{h,i}^{t}{}_{min} = 10$ s (for 1 tram composition/cycle/in direction), if greater – $t_{h,i}^{t}{}_{min} = 20$ s (for 2 tram compositions/cycle/in the direction).

2.3. For pedestrians $t_{h,i}^{p}$ — depending on the intensity of pedestrian traffic flow P, pedestrians/hour/walkway:

$t_{h,i}^{p}{}_{min} = 6$ s; (38)

$t_{h,i}^{p}{}_{min} = B/v_P$ if $B \leq 12.0$ m; (39)

$t_{h,min}$= 0.75 * B/v_P if B ≥ 12.0 m or P ≤ 120 pedestrians/hour

where B is the length of the pedestrian walkway together with the dividing strip; V_P= 1.20 m/s

the greater value of formulae (38) and (39) shall be taken as applicable.

$t_{h,i}^{p}{}_{min}$= [(B+u)+P]/ v_p (39′), where there is a dividing strip and the pedestrians cross at once, where: P is the number of pedestrians crossing a pedestrian walkway [pedestrians/hour], P ≥ 2 m – length of the 'pedestrians' package [m], multiple of 0.50 m, V_P — pedestrian speed (v_P= 1.20 m/s), b – width of the pedestrian walkway [m], B – the greater width of the running lanes [m], u – width of the dividing strip or rescue island [m] (Figure 6); it shall be taken as the highest value of equations (38) and (39) or (39′); if the pedestrian traffic flow is disturbed by turning cars during the same phase:

$t_{h,i}^{p}{}_{min}$= 3 + (39) or (39 '). (40)

2.4. For bicycles $t_{h,i}^{c}$:

$t_{h,i}^{b}{}_{min}$= 6 s (40 ′)

2.5. Sufficiency check for passing of pedestrian, tram and bicycle traffic:

2.5.1. For pedestrians:

$t_{h,i}$+ t_M^{i}+ t_M^{i-1}— $t_{M,P}^{i-1}$≥ $t_{h,i}^{p}{}_{min}$+ $t_{M,P}^{i}$. (41)

2.5.2. For trams:

$t_{h,i}$+ t_Mi+ t_M^{i-1}- $t_{M,T}^{i-1}$≥ $t_{h,i}^{t}{}_{min}$+ $t_{M,T}^{i}$. (42)

2.5.3. For bicycles:

$t_{h,i}$+ t_Mi+ t_M^{i-1}— $t_{M,C}^{i-1}$≥ $t_{h,i}^{c}{}_{min}$+ $t_{M,C}^{i}$. (42′)

2.5.4. The check shall be carried out simultaneously for trams, pedestrians and bicycles.

If the condition in formula (41) is not met, select a new higher value of $t_{h,i}$:

$t^*_{h,i}$= $t_{h,i}^{p}{}_{min}$+ $t_{M,P}^{i}$- t_Mi- t_M^{i-1}+ $t_{M,P}^{i-1}$. (43)

If the condition in formula (42) is not met, select a new higher value of $t_{h,i}$:

$t^*_{h,i} = t_{h,i}{}^{t}_{min} + t_{M,T}i - t_M i - t_M{}^{i-1} + t_{M,T}{}^{i-1}$. (44)

If the condition of Formula (42′) is not met, select a new higher value of $t_{h,i}$:

$t^*_{h,i} = t_{h,i}{}^{c}_{min} + t_{M,C}i - t_M{}^{i} - t_M{}^{i-1} + t_{M,C}{}^{i-1}$. (44′)

If the conditions in formulae (41), (42) and (42 ′) are not met at the same time for $t^*_{h,i}$ select the greater of the three values by equations (43), (44) and (44 ′).

2.5.5. Recalculate $t^*_{h,i}{}^{ef} = t^*_{h,i} + 1$ according to formula (36) and the new cycle and phases respectively.

2.6. Checking the possibility of passing left-turning vehicles while waiting for oncoming traffic (only if there is a separate left-turn lane):

$P_l = t_h{}^{unsatur} * S_L / T_c$ [E/h] (45), where P_l is the left turn capacity, $t_h{}^{unsatur}$ — unsaturated part of the relevant vehicle clearance signal, s_L — left-turn saturated flow [E/h];

$t_h{}^{unsatur} = (S * t_h{}^{ef} — Q_{counter} * T_c)/(S - Q_{counter})$ [s] (46), where $Q_{counter}$ is intensity of oncoming traffic, E/h; s – saturated flow for the counter-movement determined in accordance with points 2.1.2 to 2.1.4;

$S_L = Q_{counter} * (1 - \beta * Q_{counter}/3600)/\{e\text{^}[(\alpha - \beta) * Q_{counter}/3600]\} * [1 - e\text{^}-(\beta_L * Q_{counter}/3600)]$ (47) where α is a minimum counter-flow interval sufficient for the passage of a left turning car, in s; β – minimum counter flow interval, s; β_L – minimum left-turn flow interval, s.

α = 5 s; β = 3 s; β_L = 2.5 s, with two or more counter-flow lanes: α = 6 s; β = 1 s; β_L = 2.5 s.

2.6.1. Inspection:

(a) $P_l \geq Q_{leftвo}$ - there is no need for a standalone phase for the left turn;

(b) $P_l < Q_{leftвo}$ - there is a need for a standalone phase for the left turn, accordingly revising the number of phases and starting the calculations from the beginning, or the left turn shall be prohibited.

Note: The results of formulae (19), (30), (32), (33), (34), (36), (39), (39′) are accurate up to 1 second.

3. Clearance signal capacity for cars:

3.1. The duration of the clearance signal $t_{h,i}$ depending on the number of cars passed L_c is:
$t_{h,i} = 1.8 * L_c + 0.9$ [s] (48); here $L_c = (t_{h,i} - 0.9)/1.8$ [No/cycle] (48 ′), if a value of less than 6 is obtained,

Table 4 shall be used:

L_c N/cycle	1	2	3	4	5
$t_{h,i}$ sec.	0.8	3.4	5.7	7.8	9.8

3.2. The throughput capacity T_i of the clearance signal for cars $t_{h,i}$:

$T_i = L_c * 3600/T_c$ [E/h]. (49)

3.3. The throughput capacity of the regulated zone:

$T = {}_1\sum^f T_i$ [E/h]. (50)

4. Determination of car hold-ups at the regulated zone

4.1. Average hold-up per vehicle from the respective entrance and phase d_i:

$d_i = T_c * A' + (3600 * B'/Q_i) - C'$ [s/car] (51), where Q_i is the input movement at the corresponding entrance and phase, in E/h;
$A' = [(1-\lambda_i)^2]/[2*(1-\lambda_i * x_i)]$ (52); $B' = x_i^2/[2*(1-x_i)]$ (53);

$C' = 0{,}65*\{[T_c/(Q_i/3600)^2]^{1/3}\}*x_i^{(2+5*\lambda_i)}$ (54), where $\lambda_i = t_{h,i}^{ef}/T_c = (t_{h,i}+1)/T_c$ (55); $x_I = Q_I/(\lambda_i * S_i)$ (56) – degree of saturation at the entrance to the regulated zone.

4.2. The total hold-up of the entrance and phase D_i shall be:

$D_i = d_i * Q_i$ [car-seconds/hour]. (57)

4.3. The total hold-up of the regulated zone D shall be:

$D = {}_1\sum^h D_i = {}_1\sum^h (d_i * Q_i)$ [car-seconds/hour] (58), where h is the number of traffic directions.

4.4. The average hold-up of a car at the regulated position d_{av} is:

$d_{av} = D/{}_1\sum^h Q_i$ [seconds/car]. (59)

5. Determination of parameters under flexible control mode:

5.1. The essence and the difference from the fixed control mode is that if an interval occurs in the vehicle flow greater than a preset value, a switch-over to the next control phase is effected. The interval shall be measured by inductive frames or sensors located 35 - 40 m in front of the stop line. The cycle is

variable:

$T_{c,\,min} \leq T_c \leq T_{c,max}$. (60)

1.1.5. Determination of the minimum cycle duration $T_{c,min}$:

$T_{c,min} = {}_1\sum^{f}(t_{h,\,i}^{min} + t_M^{i})$ (61) as $t_{h,\,i}^{min}$ for each phase shall be defined under two conditions:

1. To be able to withdraw vehicles from the so-called "dead" zone between the frame (sensor) and the stop line. Number of the cars L_c in the 'dead' zone of length s is: $L_c = s/6$ [No] (62). At $L_c \geq 6$ $t_{h,i}^{min}$ се определя по формула (48), while at $L_c < 6$ $t_{h,i}^{min}$ shall be determined in accordance with Table 4.

2. To ensure the passage of pedestrians, bicycles and/or trams. Check by formulae (43), (44) and (44′).

Select the greater of the two values under conditions 1 and 2.

5.1.2. Determination of maximum cycle duration $T_{c,max}$:

$T_{c,max} = {}_1\sum^{f}(t_{h,\,i}^{max} + t_M^{i})$ (63) as $t_{h,i}^{max}$ for each phase is: $t_{h,i}^{max} = (1.2\text{-}1.3) * t_{h,i}$ (64).

$T_{c,max}$ shall be assumed to be greater than the optimum cycle defined in point 2.

5.1.3. Determination of maximum flow interval $t_{ек}$:

$t_{ек} = 3.6 * s/V_{av}$ [s] (65), precision 0.1 s, where V_{av} is the average speed of the vehicles at the green signal at the entrance of the regulated zone, assumed to be 30 - 40 km/h or measured on site; $t_{ек}$ shall be determined for each phase separately, it is desirable to be the same value for all phases.

5.2. Flexible mode with control phase(s) requested.

5.2.1. In this case, the traffic lights system operates with a minimum cycle formed by the phases that are not subject to request and with a maximum cycle formed by all phases. Phase(s) shall be requested via inductive frames or occupancy sensors placed at a distance of 2 to 4 m in front of the stop line, or via a pedestrian or bicycle button.

5.2.2. The duration of the phase by request shall be fixed and shall be determined in accordance with point 2, taking into account the maximum load during the day by RTVs, pedestrians, bicyclists or transport lines for the vehicles of regular public transport of passengers.

5.2.3. In case of two phases of regulation, the phase without requesting shall be of duration $t_{h,i}^{min} \leq t_{h,\,i} \leq \infty$;

$t_{h,i}^{min}$shall be determined in accordance with point 2.

6. Transport and technical parameters of traffic control:

6.1. Reserve throughput at the regulated zone P_r:

$P_r\% = (Y_{pract} - {}_1\sum^f y_i)*100/{}_1\sum^f y_i$ (66) where $Y_{pract} = 0.9-0.0075 * L.$ (67)

For the amount of the holds-up to be acceptable, it needs $P_r\% \geq 15\%$

6.2. Traffic level of service in a single approach at a regulated zone A – F

Level of service	Transport hold-up d_i s/car determined in accordance with point 4
A	≤25
B	26 - 35
C	36 - 50
D	51 - 70
E	71 - 100
F	>100

Level A - Most road users can pass the regulated zone unimpeded. Waiting times are short.

Level B - All road users arriving at a prohibitive signal may proceed at the next clearance signal. Waiting times are short.

Level C - Almost all road users arriving at a prohibitive signal can proceed at the next clearance signal Waiting times are noticeable. For cars, only small ‘queues’ appear at the end of the clearance signal.

Level D - Permanent residual ‘queues’ are present for the vehicles. Waiting times for all road users are significant. The traffic situation is still stable.

Level E – Participants in the traffic are in significant competition with each other. Ever-growing ‘queues’ arise with cars. Waiting times are very long. The throughput has been reached.

Level F - Demand is greater than throughput. Vehicles must repeatedly move forward until they pass through the regulated zone. The ‘queues’ are constantly growing. Waiting times are extremely long. The traffic light system is overloaded.

B. In case of portable traffic light systems according to the Regulation on temporary traffic organization under Article (3)(4) of the Road Traffic Law - Figure 7

1. Intermediate times for clearing the narrow space from motor vehicles:

1.1. Time for vehicle approach towards the stop line at the end of the clearance signal – $t_{a,c}$ s – to be determined by Formula (1).

1.2. Time to clear the narrowed space from cars – $t_{clr,c}$ s – to be determined by Formula (6).

$V_{clr,c}$ is $V_{av,}$ measured on site or taken according to local conditions and road surface condition – 25 km/h in poor condition, 30 km/h in average condition and 35 km/h in good condition.

1.3. Time to reach the conflict zone from a departing vehicle at the beginning of the next clearance signal – $t_{r,c}$ s – assumed $t_{r,c}$= 0.

1.4. Intermediate times for clearing the narrow space from cars – $t^{i}_{M,C}$to be determined by Formula (19).

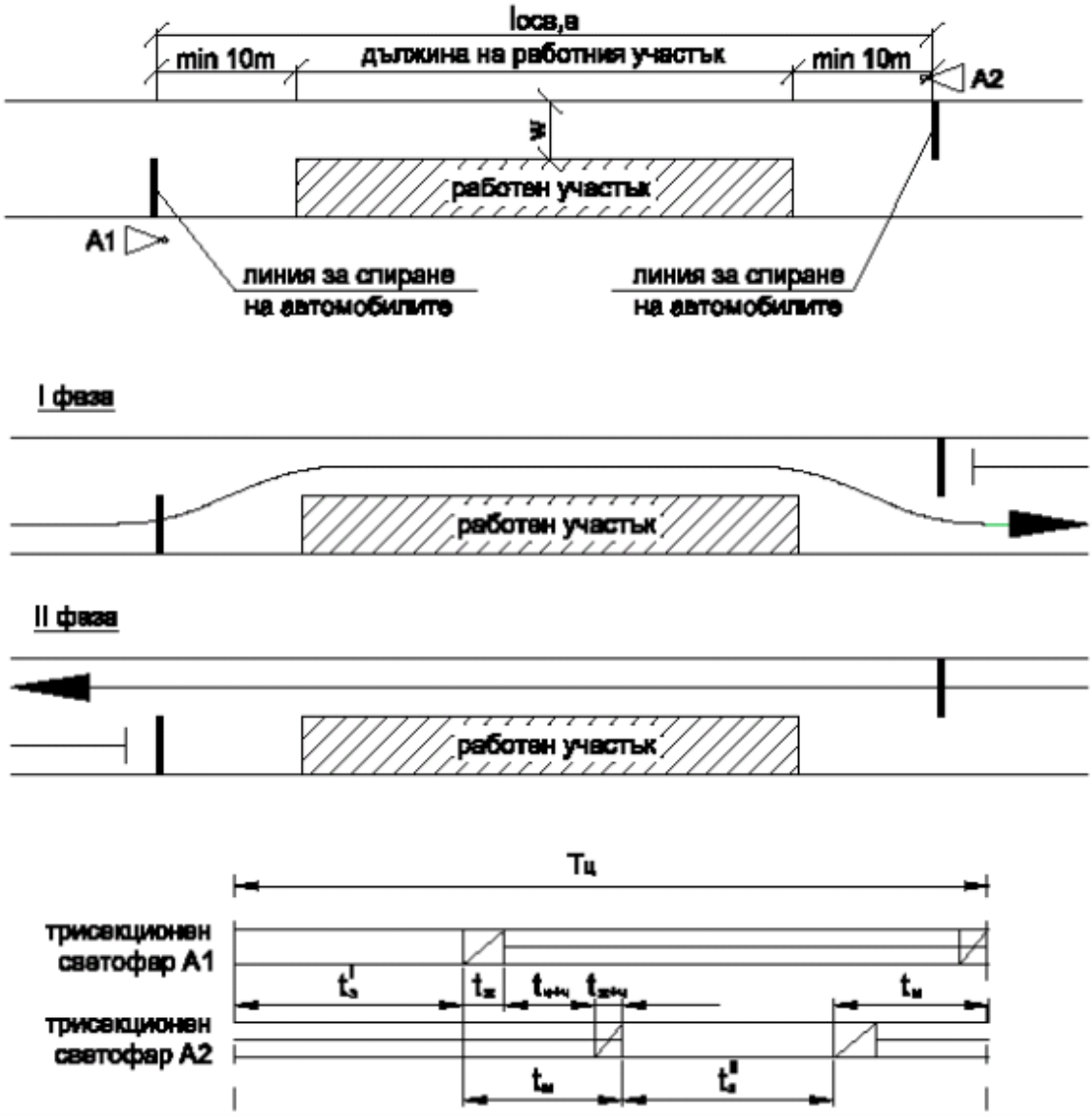


Figure 7

дължина на работния участък .	**length of the functional area.**
линия за спирана на автомобилите	**car stopping line**
работен участък	**functional area**
I фаза	**Phase I**
трисекционен светофар A1	**three-sectioned traffic light A1**
трисекционен светофар A2	**three-sectioned traffic light A2**

2. Determination of the time lost L in the regulation cycle:

L in seconds shall be determined by formulae (30) and (31).

$L_{section}$, m	l_{clr}, m	t_{clr}, s				L, s			
		Pavement condition				Pavement condition			
		poor	not good	medium	good	poor	not good	medium	good
		V_{clr}= 25 km/h	V_{clr}= 30 km/h	V_{clr}= 35 km/h	V_{clr}= 40 km/h	V_{clr}= 25 km/h	V_{clr}= 30 km/h	V_{clr}= 35 km/h	V_{clr}= 40 km/h
10	30	4.3	3.6	3.1	2.7	12.6	11.2	10.2	9.4
20	40	5.8	4.8	4.1	3.6	15.5	13.6	12.2	11.2
30	50	7.2	6.0	5.1	4.5	18.4	16.0	14.3	13.0
40	60	8.6	7.2	6.2	5.4	21.3	18.4	16.3	14.8
50	70	10.1	8.4	7.2	6.3	24.2	20.8	18.4	16.6
60	80	11.5	9.6	8.2	7.2	27.0	23.2	20.5	18.4
70	90	13.0	10.8	9.3	8.1	29.9	25.6	22.5	20.2
80	100	14.4	12.0	10.3	9.0	32.8	28.0	24.6	22.0
90	110	15.8	13.2	11.3	9.9	35.7	30.4	26.6	23.8
100	120	17.3	14.4	12.3	10.8	38.6	32.8	28.7	25.6
110	130	18.7	15.6	13.4	11.7	41.4	35.2	30.7	27.4
120	140	20.2	16.8	14.4	12.6	44.3	37.6	32.8	29.2
130	150	21.6	18.0	15.4	13.5	47.2	40.0	34.9	31.0
140	160	23.0	19.2	16.5	14.4	50.1	42.4	36.9	32.8
150	170	24.5	20.4	17.5	15.3	53.0	44.8	39.0	34.6
160	180	25.9	21.6	18.5	16.2	55.8	47.2	41.0	36.4
170	190	27.4	22.8	19.5	17.1	58.7	49.6	43.1	38.2
180	200	28.8	24.0	20.6	18.0	61.6	52.0	45.1	40.0
190	210	30.2	25.2	21.6	18.9	64.5	54.4	47.2	41.8
200	220	31.7	26.4	22.6	19.8	67.4	56.8	49.3	43.6
210	230	33.1	27.6	23.7	20.7	70.2	59.2	51.3	45.4
220	240	34.6	28.8	24.7	21.6	73.1	61.6	53.4	47.2
230	250	36.0	30.0	25.7	22.5	76.0	64.0	55.4	49.0
240	260	37.4	31.2	26.7	23.4	78.9	66.4	57.5	50.8
250	270	38.9	32.4	27.8	24.3	81.8	68.8	59.5	52.6
260	280	40.3	33.6	28.8	25.2	84.6	71.2	61.6	54.4
270	290	41.8	34.8	29.8	26.1	87.5	73.6	63.7	56.2
280	300	43.2	36.0	30.9	27.0	90.4	76.0	65.7	58.0
290	310	44.6	37.2	31.9	27.9	93.3	78.4	67.8	59.8
300	320	46.1	38.4	32.9	28.8	96.2	80.8	69.8	61.6

3. Duration of signal clearances, t_h s:

3.1. The coefficients applied for the conversion of RTVs into a converted unit shall be according to § 1, point (8) of the Additional Provision.

3.2. Determination of the initial value of saturated flows S^{I} for each phase and for each entrance to the narrowed space, according to Table 1.

3.3. Correction coefficients for narrowed space conditions:

3.3.1. For the longitudinal slope of the respective entrance as the average of the inclinations at 60 m in front of the stop line - by formula (23)

3.3.2. For traffic conditions K_t Table 2 – K_t shall not be greater than 1.

3.4. Determination of the final value of saturated flows s for each phase and for each entrance of the narrowed space by formula (28), as K_{turn}= 1.

3.5. Determination of phase factors ‘y’ for each entrance by formula (29).

3.6. Determination of the optimal duration of the control cycle T_c — formula (32) applies.

3.7. Determination of the duration of car signal clearances – formulae (34), (36), (37) and (38) apply.

3.8. Throughput P_i on the clearance signal for cars $t_{h,i}$ and, in the narrowed place, formulae (49) and (50) apply.

3.9. Check the sufficiency of the length of the waiting zone in front of the narrowed position.

3.9.1. By formula (48′) determine the number of vehicles transmitted per cycle L_c, and on the other hand

L_c= Q/n_c (68) [cars/cycle].

3.9.2. Required length of the waiting zone $l_{c,waiting}$= 6*L_c (69) [m]; n_c=3600/T_c (70) [Number/h];

$L_{c,waiting}$= Q*T_c/600 (71) [m]. The available length of the zone $l_{c,available}$ must be greater than calculated $l_{c,waiting}$. Where it is lower, the duration of the regulation cycle shall be reduced:

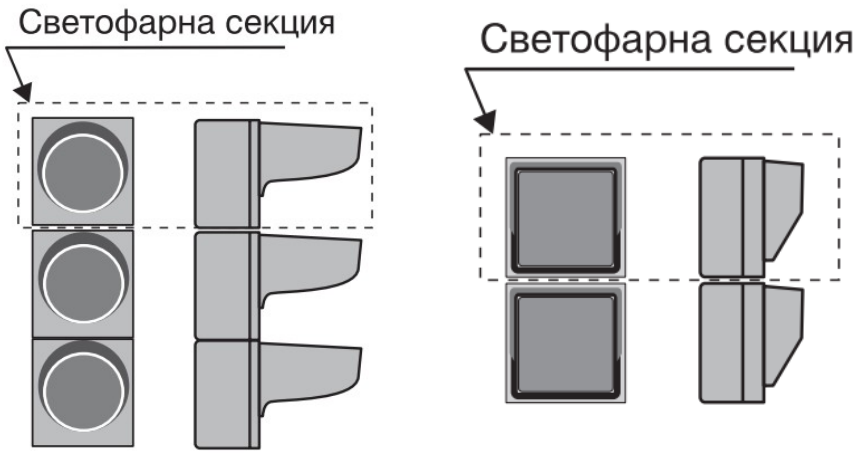
$T_{c,need} \leq 600*L_{c,available}/Q$ (72) [s].

4. Applicability:

The principles and formulae of points 1, 2 and 3 shall apply to portable traffic light systems and to fixed traffic light systems on existing roads and streets.

Annex No 2 to Article (4)(2)

Traffic light sections

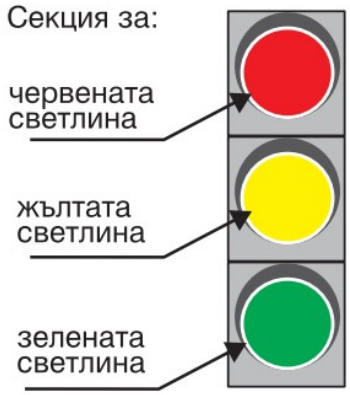


Annex No 3 to Article (13)(2) and (3)

Светофарна секция	Traffic light section

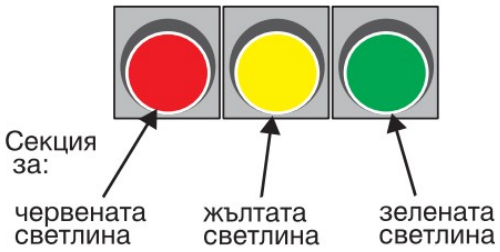
Position of traffic light sections

(a) vertical position



Секция за:	Section for:
червената светлина	red light
жълтата светлина	yellow light
зелената светлина	green light

(b) Horizontal layout



Секция за:	Section for:
червената светлина	red light
жълтата светлина	yellow light
зелената светлина	green light

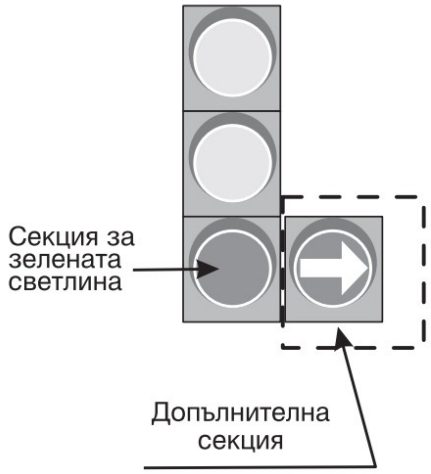
Annex No 4 to Article (13)(5)

Light fields in the shape of arrow(s)

наляво	left
направо	straight
надясно	right
наляво и надясно	left and right
Т-образно кръстовища	T-shaped intersections

Annex No 5 to Article (16)(1)

Three-sectioned traffic light with additional section



Секция за зелената светлина	Section for green light
Допълнителна секция	Additional section

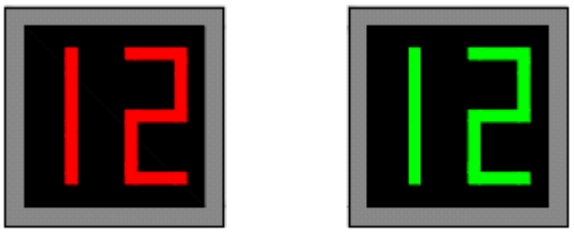
Annex 6 to Article (21)(1) and (2)

Traffic light to regulate cyclist traffic

illuminated field diameter = 100 mm

Annex No 7 to Article (22)(1), point (1)

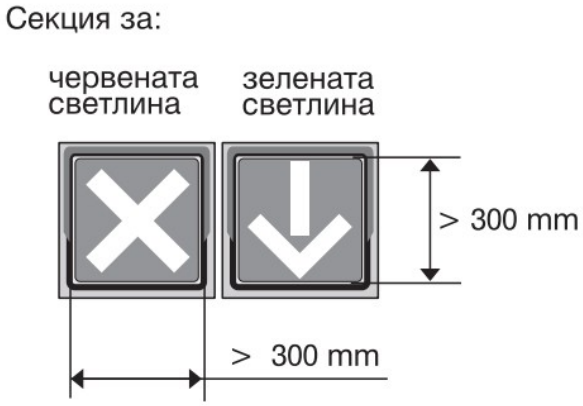
Light signal duration timing device



red or green light colour of the digits

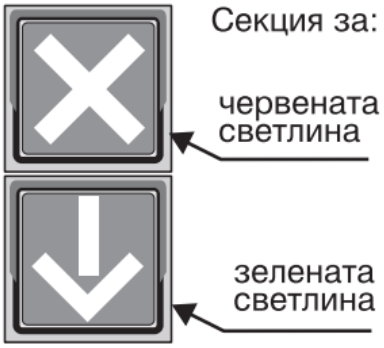
Annex 8 to Article (23)(4), points (1) and (2)

Traffic light intended to prohibit and permit vehicles to enter a traffic lane



Секция за:	Section for:
червената светлина	red light
зелената светлина	green light

(a) Horizontal positioning

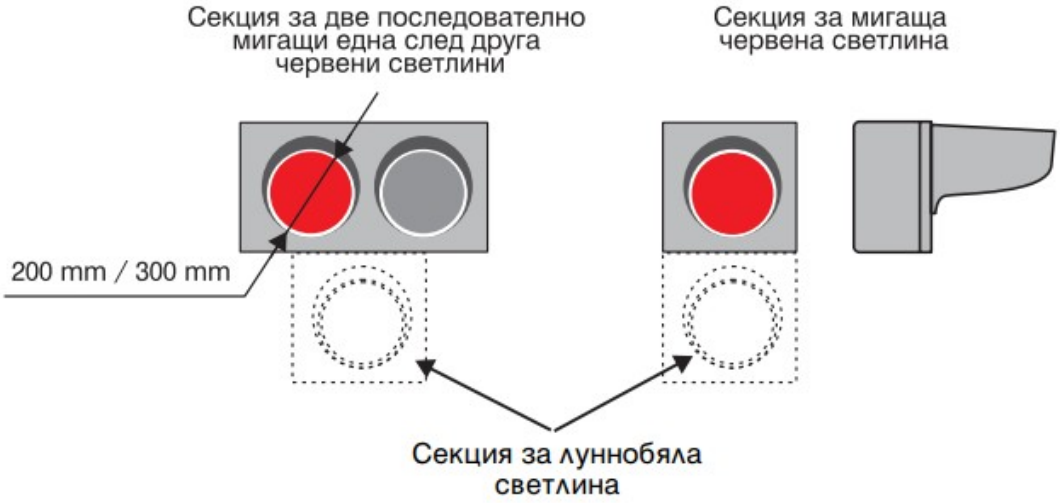


Секция за:	Section for:
червената светлина	red light
зелената светлина	green light

(b) vertical position

Annex No 9 to Article (25)(1)

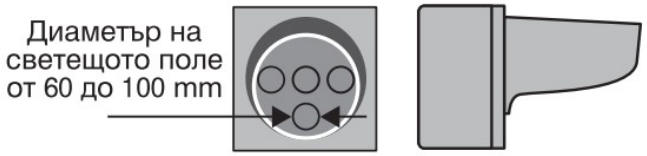
Traffic lights to prohibit vehicles from crossing a railway crossing



Секция за две последователио мигащи една след друга червени светлини	Section for two successive flashing red lights
Секция за мигаща червена светлина	Flashing red light section
Секция за луннобяла светлина	Moonlight white light section

Annex No 10 to Article (28)(1)

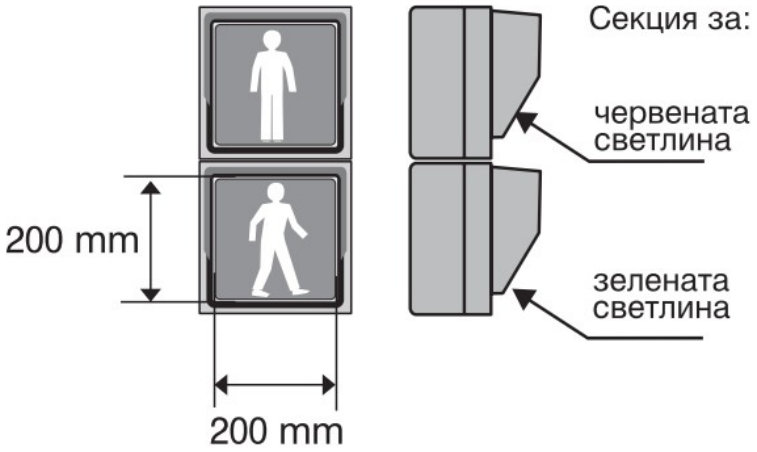
Traffic lights for regulating the movement of vehicles of the scheduled public passenger transport lines



Диаметър на светещото поле от 60 до 100 mm	Diameter of the light-emitting field – from 60 to 100 mm

Annex No 11 to Article (32)(3)

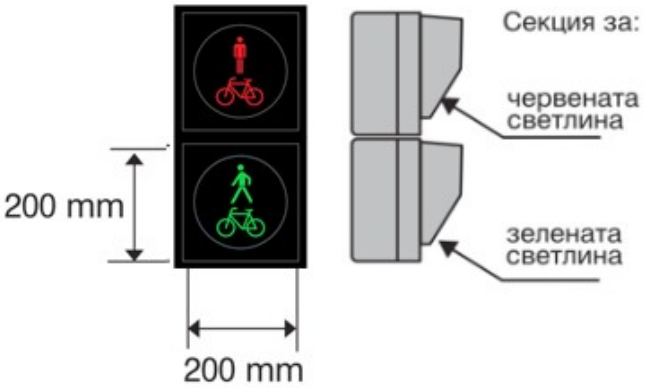
Traffic light for pedestrian traffic control



Секция за:	Section for:
червената светлина	red light
зелената светлина	green light

Annex No 12 to Article (32)(5)

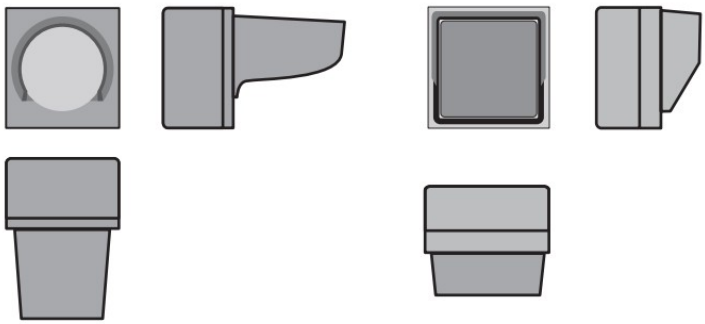
Traffic lights to regulate the traffic of pedestrians and cyclists simultaneously



Секция за:	Section for:
червената светлина	red light
зелената светлина	green light

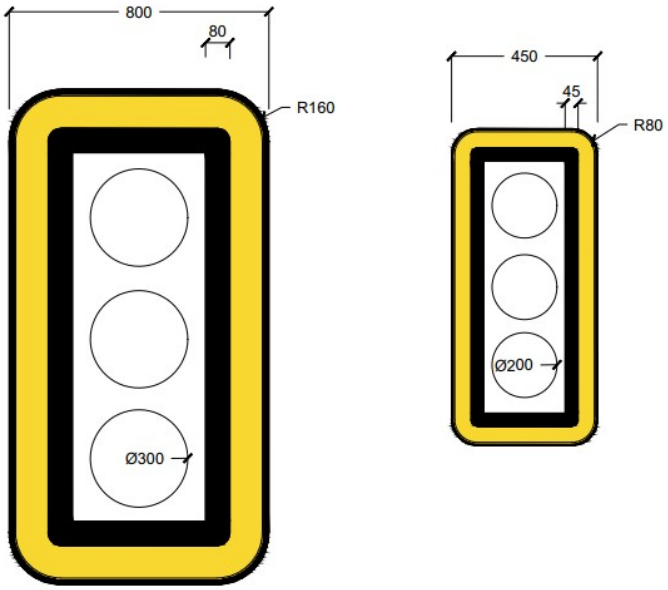
Annex No 13 to Article (40), point (4)

Sun screen of traffic light section



Annex No 14 to Article (41)(1) and (2)

Contrast screen

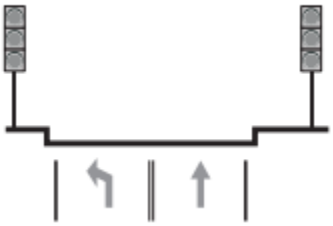


Annex 15 to Article (48)(3), points (1), (2), (3) and (4)

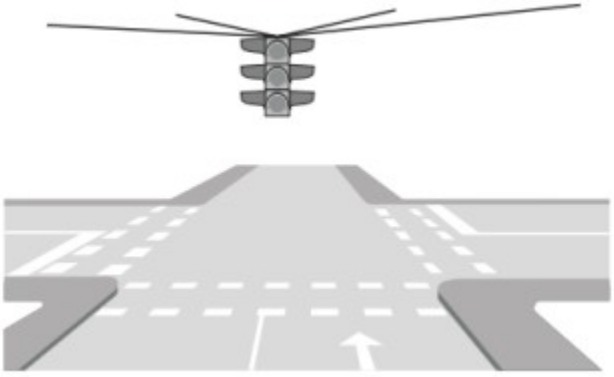
Installation of traffic lights for traffic control of road vehicles

(a) on the right side of the road, in the direction of travel

(b) above road



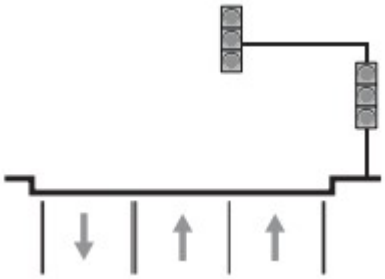
(c) on the right and on the left side of the road



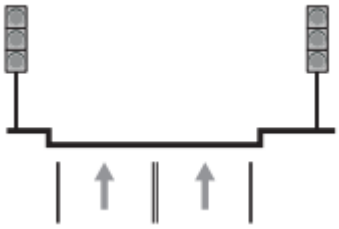
(d) in the middle of the intersection

Annex 16 to Article (48)(2), points (1), (2) and (3)

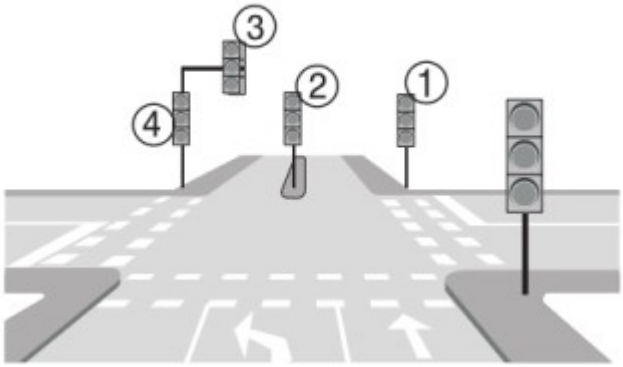
Installation of additional traffic lights



(a) above road



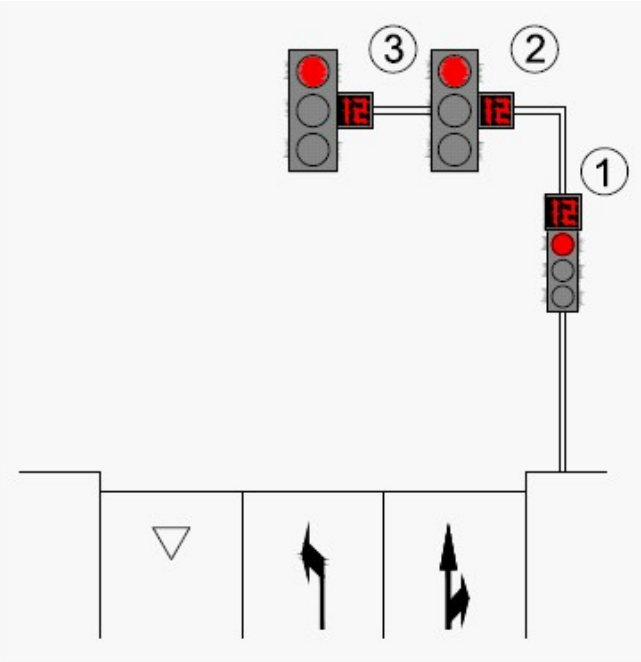
(b) on the left side of the road



(c) possible options for location at the exit of the intersection

Annex No 17 to Article 48(5), point (1)

Installation of additional traffic control devices with three-sectioned traffic lights

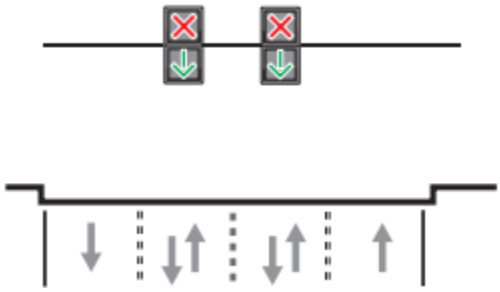


(a) possible options for installing a device to measure the duration of light signals

Annex No 18 to Article (49)(1)

Installation of a traffic light to prohibit and permit the entry of vehicles on a traffic lane

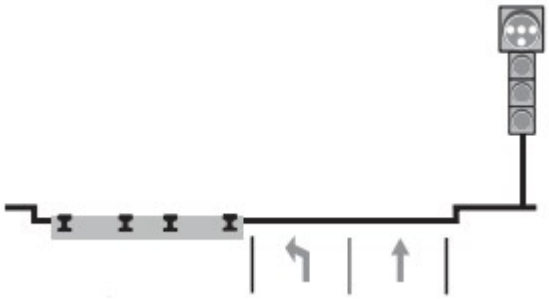
(a) horizontal layout



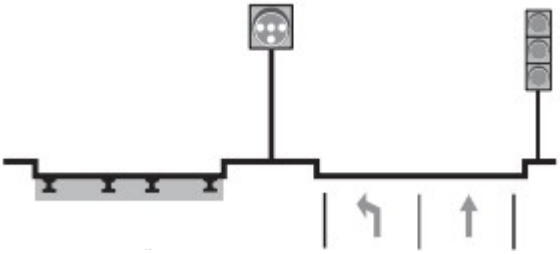
(b) vertical position

Annex 19 to Article (51)(1), point (1) and paragraph (2)

Installation of traffic lights to regulate the movement of vehicles of the scheduled public passenger transport lines



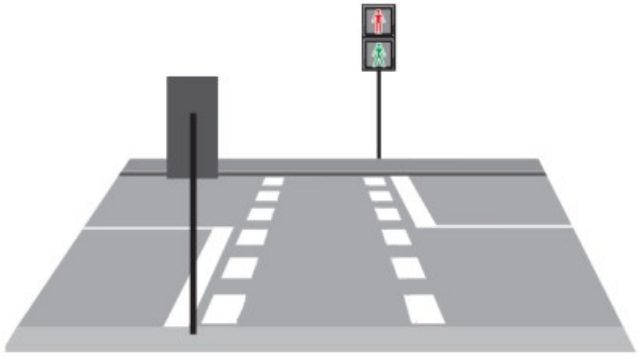
(a) on the pavement, in conjunction with the three-sectioned traffic light



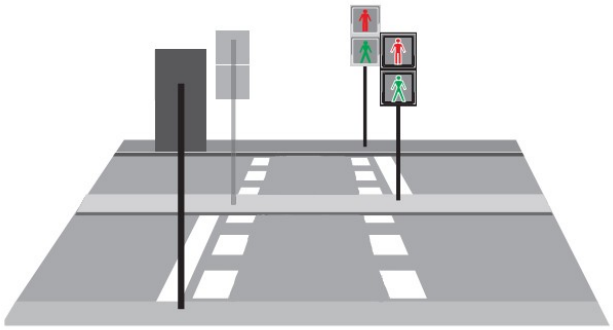
(b) stand-alone - on an island in the carriageway

Annex No 20 to Article (52)(1) and (2)

Installation of traffic lights to regulate pedestrian traffic



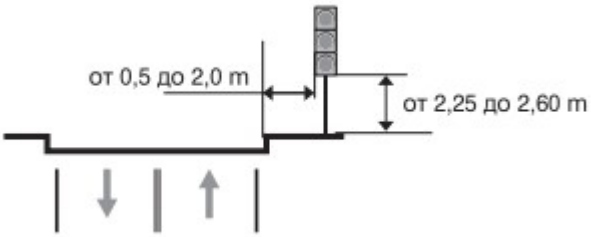
(a) opposite at both ends of the pedestrian walkway



(b) at both ends of the pedestrian walkway and on the middle dividing strip or island of the carriageway

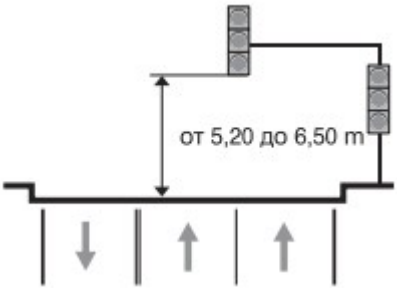
Annex 21 to Article (54)(1), points (1) and (2) and paragraph (2)

Distance from pavement to the lowest point of traffic light



ОТ 2-55 до 2,60 m	from 2.55 to 2.60 m
от 0,5 до 2,0 m	from 0.5 to 2.0 m

(a) a traffic light placed on the side of the carriageway

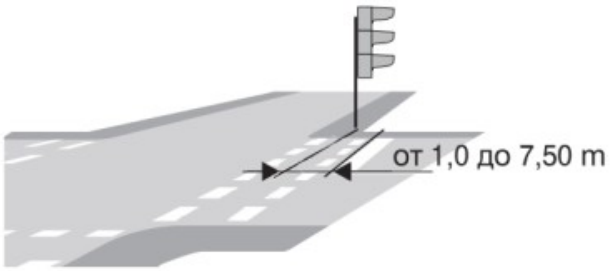


от 5,20 до 6,50m	from 5.20 to 6.50 m

(b) traffic lights placed above the carriageway

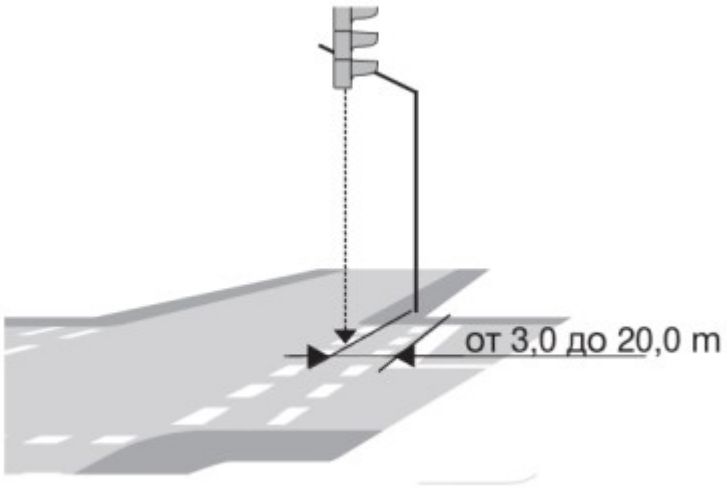
Annex No 22 to Article (54)(3) and (4)

Distance from the stop line in the case of road traffic lights



от 1,0 до 7,50 m	from 1.0 to 7.50 m

(a) a traffic light placed on the right of the traffic lane



от 3,0 до 20.0 m	from 3.0 to 20.0 m

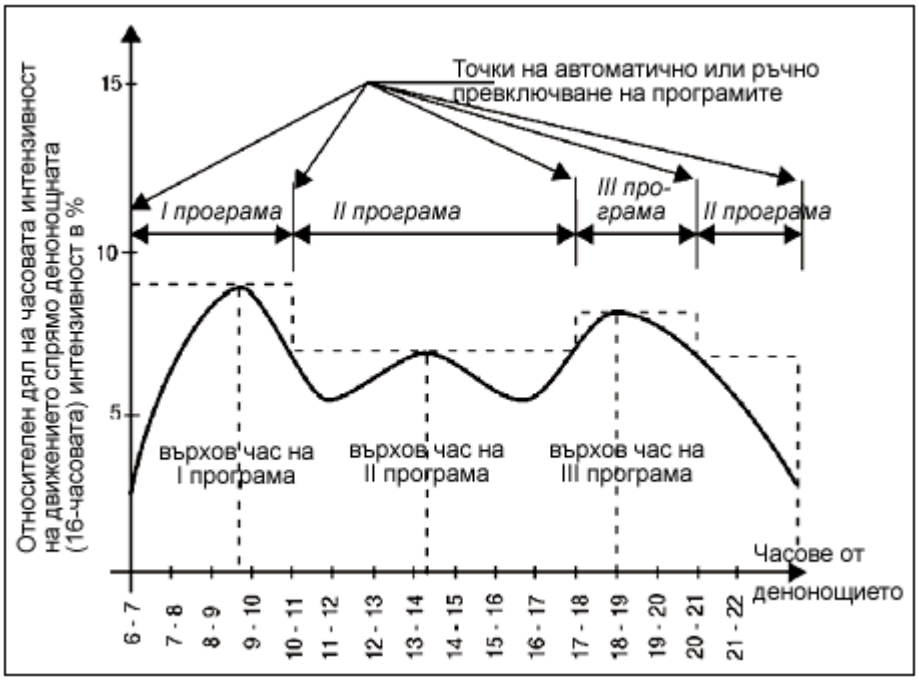
(b) traffic lights placed above the carriageway

Annex No 23 to Article (54)(5)

Distance from the pedestrian walkway when a traffic light is installed to regulate pedestrian traffic

Annex No 24 to Article (60)(1)

Determination of the number of programmes a traffic light system uses

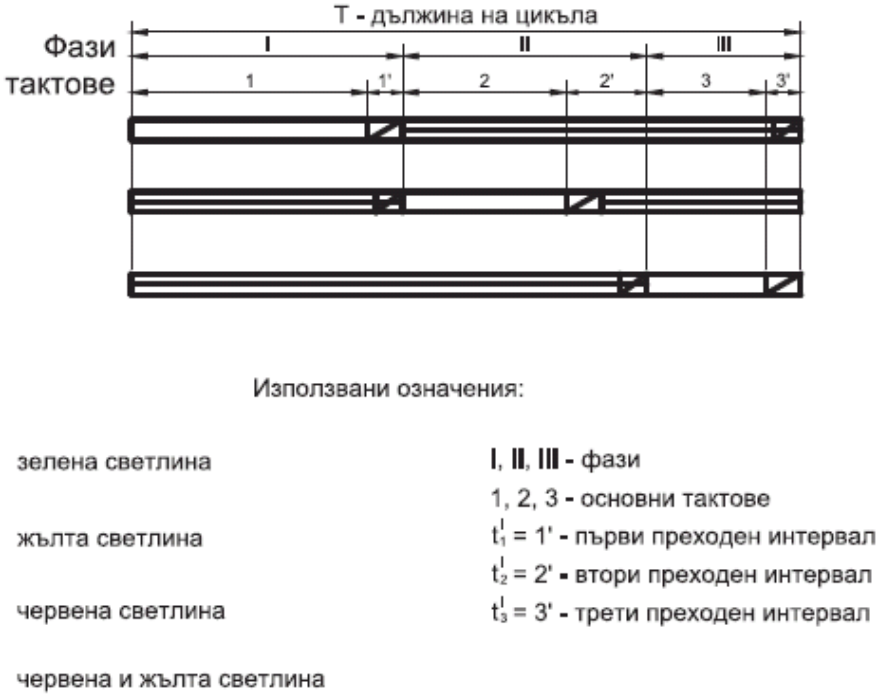


Относителен дял на часовата интензивност на движението спрямо денонощната (16-часовата) интензивност в %	Ratio of hourly traffic volume to daily (16-hour) traffic volume in %
Точки на автоматично или ръчно превключване на програмите	Automatic or manual program switching points
I програма	*I programme*

върхов час на I профана	Peak hour of programme I
Чамве от денонощието	Hours of the day

Annex No 25 to Article (62)(1)

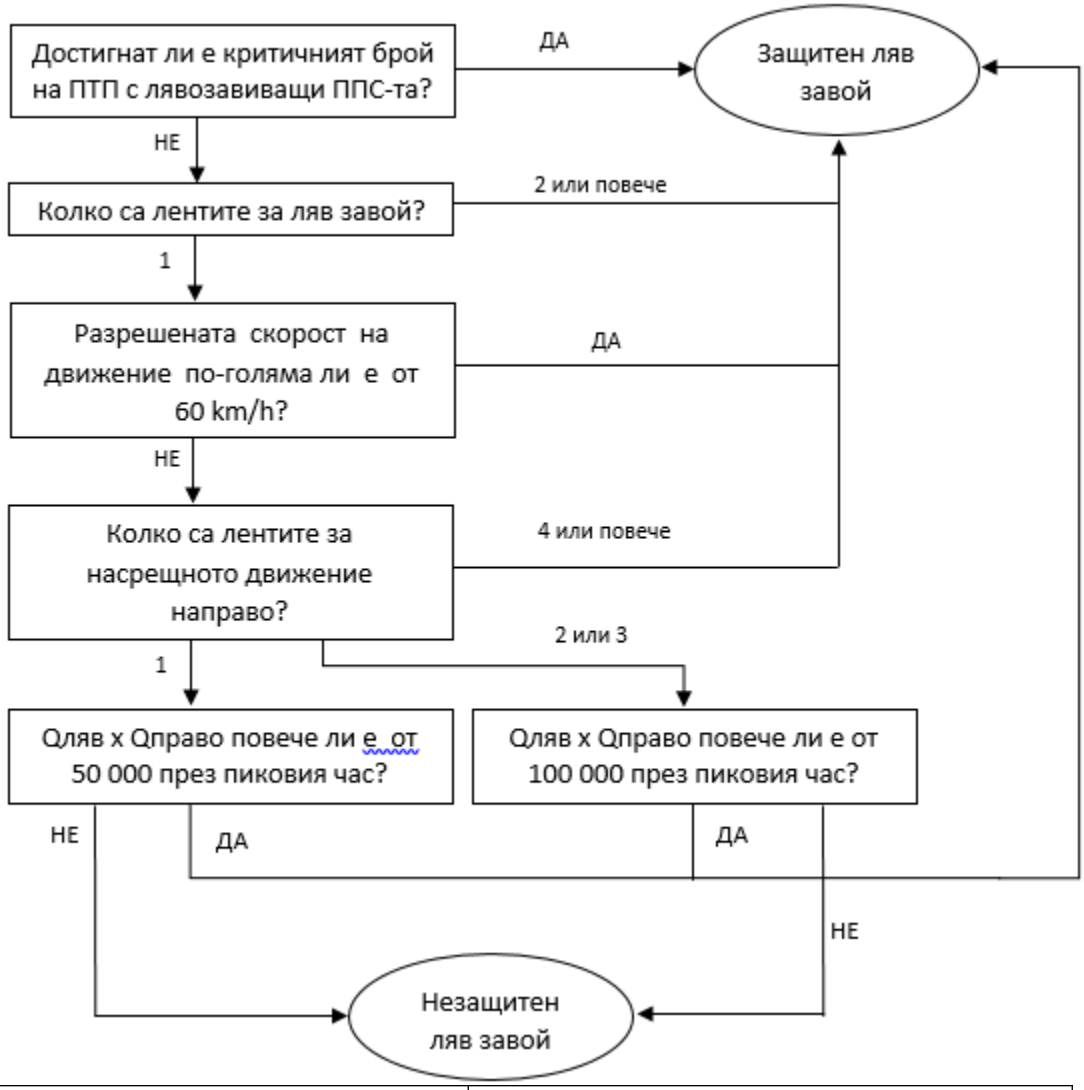
Sample order for switching traffic lights



Фази тактове	Phases, steps
T - дължина на цикъла	T – length of the cycle
Използвани означения:	Symbols used:
зелена светлина	Green light
жълта светлина	Yellow light
червена светлина	Red light
червена и жълта светлина	Red and yellow light
I, II, III - фази	I, II, III – Phases
1,2, 3 - основни тактове	1,2, 3 — main steps
t^{I}_{1} = 1' - първи преходен интервал	t^{I}_{1} = 1' — first transition interval
t^{I}_{2} = 2' - втори преходен интервал	t^{I}_{2} = 2' — second transition interval
t^{I}_{3} = 3' - трети преходен интервал	t^{I}_{3} = 3' — third transitional interval

Annex 26 to Article (63)(4)

Algorithm for determining the need for a separate clearance signal to control the movement of RTVs turning left



Достигнат ли е критичният брой на ПТП слявозавиващи ППС-та?	Has the critical number of traffic accidents with left-turning RTVs been reached?
НЕ	No
Колко са лентите за ляв завой? '	How many are the lanes for left turn? '
Разрешената скорост на движение по-голяма ли е от 60 km/h?	Is the permitted driving speed greater is from 60 km/h?
Колко са лентите за насрещното движение ' направо?	How many lanes are there for oncoming traffic straight ahead?
Оляв x Олраво повече ли е от 50 000 през пиковия час?	Is Q_{left} x Q_{right} more than 50,000 during peak hour?
ДА	YES
2 или повече	2 or more
4 или повече	4 or more
2 или 3	2 or 3
Защитен ляв завой	Protect left turn
Оляв x Оправо повече ли е от 100 000 през пиковия час?	Is Q_{left} x Q_{right} more than 100,000 during peak hour?

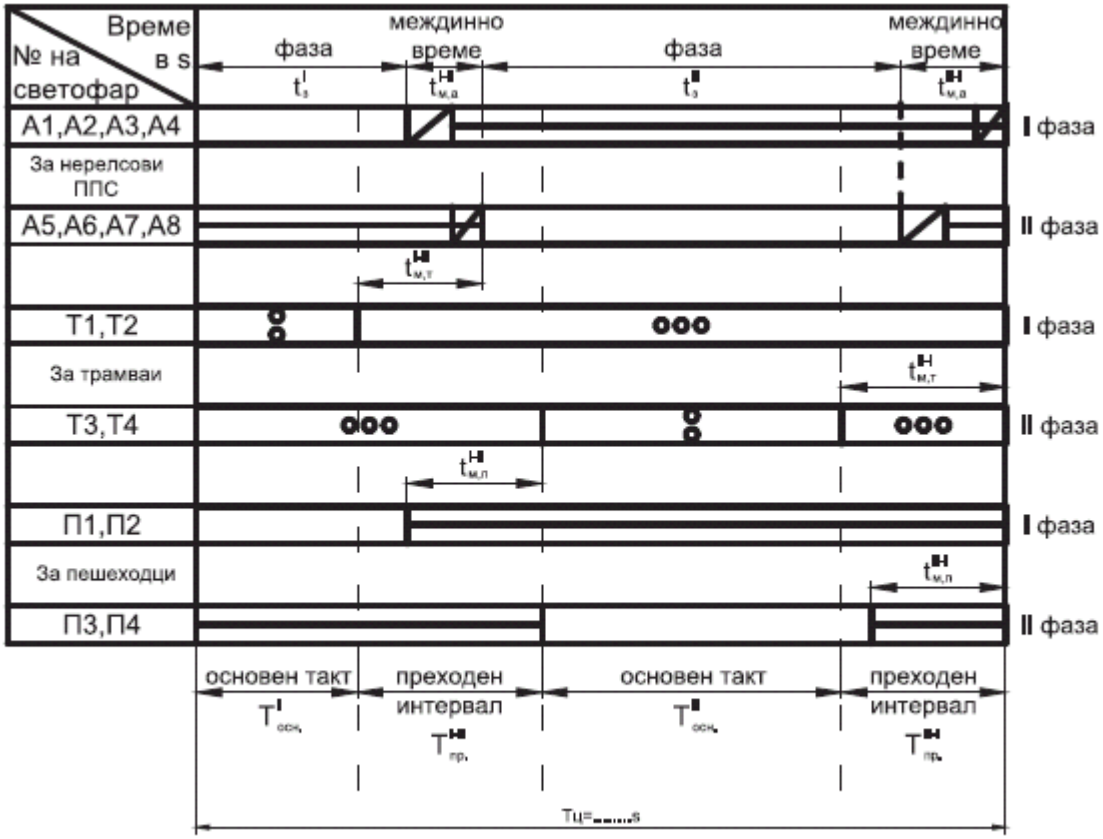
Незащитен ляв завой	Unprotected left turn

Where:
Critical number of road accidents: 4 left-hand turns per year or 6 left-hand turns for 2 years.
Q_{left} – the intensity of the flow of the vehicles turning left, [E/h].

Q_{right} – the intensity of the flow of the vehicles which continues directly and is conflicting with the left turn in question [E/h].

Annex No 27 to Article (64)(1)

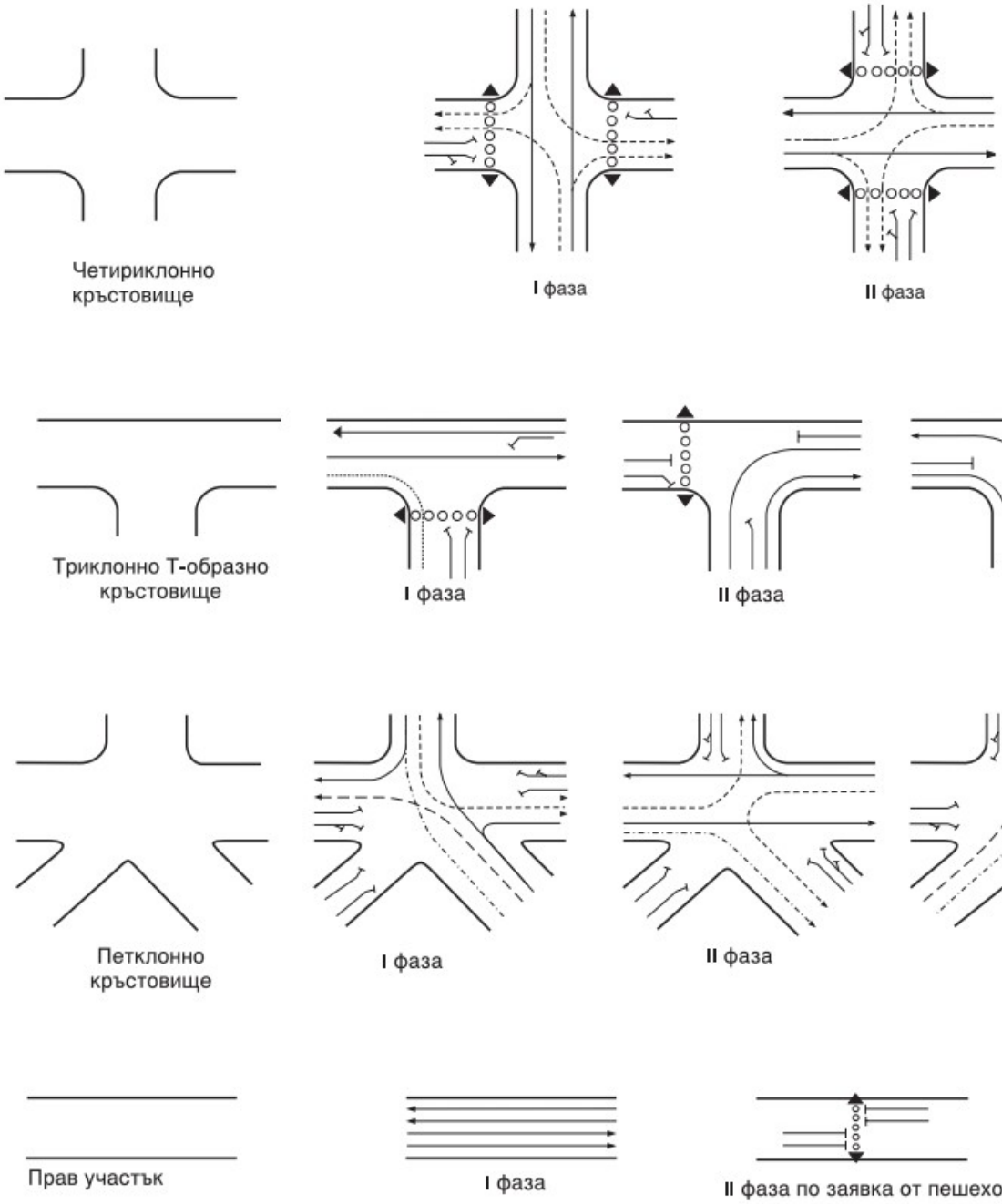
Example display of a cyclogram of traffic lights at an intersection in fixed control mode



Време в s	Time in s
№ на светофар	Number of traffic light
За нррелоааи ППС	for non-rail RTVs
А5,А6,А7,А8	A5, A6, A7, A8
За трамваи	For trams
За пешеходци	For pedestrians
Фаза	Phase
основен такт	main step
преходен . интервал	transition interval
основен такт	main step
преходен интервал	transition interval
Използвани обозначения:	Symbols used:
зелена светлина	Green light
жълта светлина	Yellow light
червена светлина	Red light
червена и жълта светлина	Red and yellow light
за трамвая - разрешено преминаването	for the tram - passage allowed
за трамвая - забранено преминаването	for the tram - prohibited passage

Annex No 28 to Article (64)(2)

Example of phase plans for more typical traffic control cases



Четириклонно кръстовище	Four-way intersection
I фаза	I phase
II фаза	II phase
Триклонно Т-образно кръстовище	Three-way T-junction
I фаза	Phase I
н фаза	Phase II
in фаза	Phase III
Петклонно кръстовище	Five-branch intersection
I фаза	Phase I
н фаза	Phase II
in фаза по заявка от клон 5	Phase III by request of a branch 5
Прав участък	Straight section
ı Фаза	Phase I

п Фаза по заявка от пешеходци	Phase II by request from pedestrians

Annex No 29 to Article (66), point (3)

Conflict-free entry of vehicles from the BUS lane into the stopping and waiting zone at an intersection